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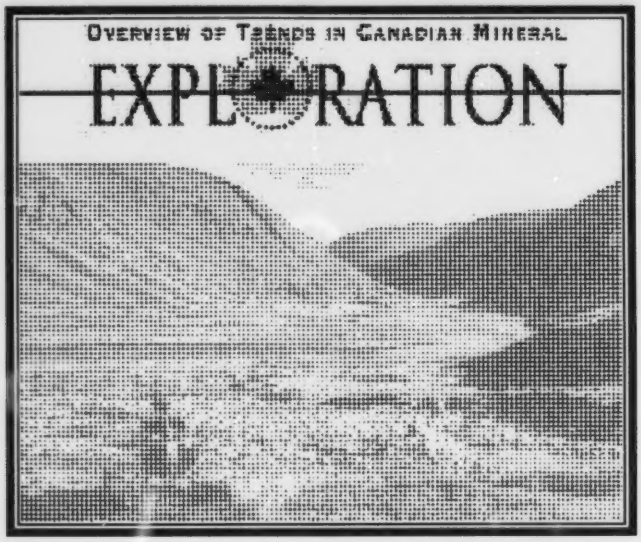

BY THE
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ON THE MINERAL INDUSTRY

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Preface

This report is prepared annually, on behalf of the Intergovernmental Working Group on the Mineral Industry (IGWG), for presentation to federal, provincial and territorial Mines Ministers. It contains the latest information on exploration expenditure levels in Canada, a review of current exploration and development activities in the provinces and territories, and commentaries on and analysis of current domestic and international trends affecting the Canadian mineral exploration sector.

Unless otherwise indicated, the data contained in this report are current as of April 1997 and the views expressed by the various authors have been assembled and agreed upon by IGWG. The Minerals and Metals Sector of Natural Resources Canada (NRCan) was responsible for compiling, editing, producing and distributing the report.

Throughout the report, the expression "mineral exploration" refers to grassroots and advanced exploration for metallic minerals, nonmetallic minerals, coal and uranium. It does not refer to petroleum-related exploration.

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Executive Summary

Canadian mineral exploration remains strong. Exploration expenditures have been growing since 1992 when spending was at a low of $385 million. Subsequently, expenditures increased to $477 million in 1993, $628 million in 1994, $718 million in 1995, and $873 million (prelimi-nary survey results) in 1996. Company spending intentions, as compiled in January 1997, reveal that $876 million could be spent on

exploration in Canada in 1997.

In 1996, the Northwest Territories, Ontario, Québec and British Columbia were Canada's most actively explored jurisdictions. Exploration expenditures increased in all provinces and territories, but those in Ontario and British Columbia increased the most. In 1997, Ontario, the Northwest Territories, British Columbia and Québec are expected to account for about 70% of total exploration expenditures in Canada. Spending is expected to increase in six provinces and territories, with the greatest increases occurring in Saskatchewan, Ontario and British Columbia.

Expenditures by junior exploration companies rose by 43% to $306 million in 1996. According to the federal-provincial survey of mining and exploration companies conducted in the last quarter of 1996 and January 1997, these expenditures are expected to increase by a further 9% in 1997 to $334 million. Senior company spending amounted to $567 million in 1996. As opposed to junior companies, seniors are expected to reduce their exploration expenditures in 1997 to $542 million.

Exploration for diamonds in Canada continues to draw worldwide attention. Including 1997 spending intentions, more than $640 million will have been spent on the search for diamonds in

Canada during the period 1993-97. While grassroots exploration continues to find new diamond exploration targets, the major projects are now moving to the advanced exploration and development stages. Therefore, Canada appears destined to become a major diamond-producing nation within the next few years.

The exploration effort sparked by the 1994 discovery of the Voisey's Bay nickel-copper-cobalt deposit in Labrador continued unabated. Although claim staking in Newfoundland and Labrador returned to a more normal level in 1996, exploration expenditures reached a provincial record of $91 million. An additional $73 million in expenditures is forecast for 1997, indicating continued interest in that part of the country.

Globally, Canada remains one of the world's top mineral exploration targets. Canada will continue to challenge Australia for first place in 1997. Canadian companies are also continuing to increase their exploration and mining activities abroad. They now control almost 30% of the world's larger-company market for precious-metal, base-metal and diamond exploration, and they hold the dominant share of that market in both Canada and Latin America. With its domestic strength and growing international presence, the Canadian exploration sector continues to be a driving force for mineral exploration activities worldwide.

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1. Canadian Mineral Exploration Expenditures

1.1 INTRODUCTION

This section highlights the 1996 preliminary survey results for exploration expenditures and the 1997 company spending intentions for Canada, as obtained through the federal-provincial survey of mining and exploration companies (described in Appendix A). A statistical model, designed by NRCan's Minerals and Metals Sector, is also used to predict the amount of junior and senior company mineral exploration spending that could occur in 1997.

1.2 1996 EXPLORATION EXPENDITURES

1.2.1 Statistical Summary

In 1996, some 667 companies (project operators) spent $873 million on mineral exploration in Canada (Figure 1). That amount represented an increase of 22% ($155 million) over 1995 expenditures. A total of 146 companies (compared to 117 in 1995) each spent $1 million or more on exploration; these companies' expenditures accounted for 86% of the total expenditures for 1996.

Spending increases were recorded in all provinces and territories (Figure 2). Major increases occurred in Ontario (31% of the $155 million), British Columbia (24%), Newfoundland and

Labrador (13%), the Yukon (10%), and the Northwest Territories (7%). In decreasing order of amounts spent on exploration, the Northwest Territories, Ontario, Québec, British Columbia,

and Newfoundland and Labrador accounted for 80% of all exploration expenditures in Canada.

In 1996, expenditures for general (off-property) exploration activity increased by 23% over 1995. Overall, $774 million, or 89% of all exploration expenditures, were for general exploration activity. The Northwest Territories ranked first in general exploration activity with 23% of the total, followed by Ontario and Québec with 18% and 14%, respectively.

Mine-site exploration expenditures increased by 14% to $98.3 million. Mine-site exploration expenditures

contributed up to 10% of the respective exploration totals recorded for Nova Scotia, Saskatchewan, British Columbia, the Yukon, the Northwest Territories, and Newfoundland and Labrador; up to 20% for New Brunswick, Québec, Ontario and Manitoba; and more than 40% for Alberta.

1.2.2 Spending by Junior and Senior Firms

A total of 168 senior project operators (non-junior companies) accounted for 65% ($567 million) of all exploration expenditures in 1996 (**Figures 1** and **2**). Their share of total exploration expenditures represented an increase of 12% over 1995 when about the same number of senior project operators spent $504 million.

About 70% of the expenditures reported by senior firms occurred in the Northwest Territories, Ontario, Québec and British Columbia (in decreasing order). Senior firms increased their expenditures in 1996 in most provinces and territories except Nova Scotia, the Yukon, the Northwest Territories and Québec. The latter two experienced less significant decreases than Nova Scotia and the Yukon. The spending increase by senior firms exceeded 40% in Newfoundland and Labrador.

Senior companies were the main contributors to exploration expenditures in all provinces and territories except the Yukon, Nova Scotia and British Columbia. In British Columbia, senior expenditures almost equalled spending by the juniors. The share of senior expenditures exceeded 80% of total expenditures in Manitoba and Saskatchewan.

The number of junior project operators rose to 509 in 1996, an increase of only 2% over the 500 recorded in 1995. Since only aggregated prospectors' expenditures are provided by provincial survey partners, prospectors are not counted in this total. Moreover, some provinces do not survey prospectors because of resource and time constraints. Generally, prospectors account for, at most, about 2% of total Canadian exploration expenditures.

Altogether, junior companies and prospectors spent $306 million in 1996, a 43% increase over 1995. Junior exploration expenditures roughly doubled in the Yukon and Ontario, and tripled in Nova Scotia. Other increases varied between 7% and 68% with the low end of the range being registered in Alberta and the high end in New Brunswick. A small decrease in junior expenditures was recorded in Saskatchewan. In decreasing order of expenditures, the Northwest Territories, British Columbia, Ontario and Québec accounted for 68% of all junior expenditures in 1996.

1.2.3 Main Exploration Targets

The two main exploration properties or groups of properties for each province and territory in 1996 are listed in Appendix B (**Table 18**). Expenditures on the projects listed in this table totalled $237 million and represented 27% of all exploration expenditures in Canada for that year. In fact, by themselves, 21 companies accounted for $253 million, or 29% of all exploration expenditures in Canada in 1996. Close to 80% of those expenditures were made by seniors.

Emphasis was placed on diamond exploration in the Lac de Gras area of the Northwest Territories, and on nickel-copper-cobalt exploration in the Voisey's Bay area of Labrador. In Newfoundland and Labrador alone, the two main properties accounted for more than half of the total provincial exploration expenditures.

1.3 1997 EXPLORATION EXPENDITURES - AN OUTLOOK

1.3.1 Statistical Summary

In 1997, 607 companies (project operators) intend to spend $876 million on exploration in Canada (**Figure 1**). Despite a 9% reduction in the number of companies, expenditures are still expected to increase by less than 1% over 1996. A total of 161 companies (145 in 1996) each intend to spend $1 million or more. These 161 companies expect to spend a total of $771 million, or 88% of total intended expenditures for 1997.

Almost 70% of the total exploration expenditures will be reported, in decreasing order, by Ontario, the Northwest Territories, British Columbia and Québec (**Figure 2**). Increases in exploration expenditures are

expected in six provinces and territories for a total increase of $41 million. Those provinces/territories are Saskatchewan, Ontario, British Columbia, the Yukon, Manitoba and Nova Scotia. Altogether, increases in Saskatchewan, Ontario and British Columbia should account for 86% of the $41 million.

Total decreases of $37 million are foreseen for Newfoundland and Labrador, Québec, the Northwest Territories, Alberta and New Brunswick. About 82% of the total decrease is expected to occur in Newfoundland and Labrador and in Québec.

Company spending intentions (**Table 17**, **Appendix A**) indicate that expenditures on general exploration are expected to decrease by less than 1% from $774 million in 1996 to $771 million in 1997. This type of expenditure is expected to account for 88% of total spending. Mine-site expenditures are expected to increase by 7% to reach $105 million in 1997.

1.3.2 Spending by Junior and Senior Firms

In the federal-provincial survey compiled in January 1997, 164 senior companies indicated their intention to spend $542 million, representing 62% of total forecast 1997 exploration expenditures and a 4% decrease in senior company expenditures from 1996.

Most of the expenditures by senior firms are expected to occur in Ontario, the Northwest Territories and Québec. In 1997, senior company expenditures are expected to exceed 80% of total exploration expenditures in each of Saskatchewan, Manitoba, Alberta and New Brunswick. Expenditures by senior companies are forecast to decrease in most regions except Saskatchewan, New Brunswick and Ontario.

The number of junior company project operators is expected to decrease by 13% in 1997. However, this reduced number of companies is expected to contribute a significantly higher level of expenditures than in 1996. Juniors should spend $334 million in 1997, a 9% increase from the $306 million spent in 1996. The amount spent by juniors should increase in most provinces and territories.

The extent of the increase is expected to vary between 12% in Ontario and 41% in British Columbia. Decreases are expected in Alberta (down by 43%), New Brunswick (26%), Québec (8%), the Northwest Territories (6%), and Newfoundland and Labrador (5%).

In 1997, 94 junior companies (compared to 78 in 1996) each intend to spend $1 million or more on exploration. They are expected to account for 29% ($253 million) of all exploration expenditures compared to 24% ($212 million) in 1996. Sixty-eight senior companies (about the same number as in 1996) each intend to spend $1 million or more in 1997. These companies are expected to account for 59% ($518 million) of total exploration expenditures compared to 62% ($542 million) in 1996.

1.3.3 Main Exploration Targets

The two main exploration properties or groups of properties for each province and territory in 1997 are listed in **Appendix B** (**Table 19**). Planned expenditures for these projects total $246 million, or 28% of all intended exploration expenditures. For Canada as a whole, 21 companies reported $279 million, or 32% of all intended expenditures for 1997. About 80% of those expenditures will be incurred by senior companies. As in 1996, the main exploration targets are diamond deposits in Canada's North and base-metal deposits in Labrador. Again, the two main projects for Newfoundland and Labrador represent in excess of 50% of total exploration for that province.

1.3.4 Outlook for Exploration Based on Statistical Estimation

1.3.4.1 Methodology

In this section, an attempt is made to predict the level of exploration for 1997 using standard statistical estimation techniques. Exploration spending is estimated by linking historical exploration spending to factors for which historical data are available.

An analysis of historical data indicates that the level of expenditures on mineral exploration in a given year can be linked to the previous year's metal prices. This may be because companies view exploration as an investment, with expected returns on that investment being dependent on expected revenues from the

subsequent mining of discovered deposits. Expected future revenues would obviously depend on future mineral and metal prices, and expectations of future prices would likely be influenced by current prices. As well, metal prices influence the level of a mining company's revenues and profits, and are an important determinant of the amount of internal funds available for mineral exploration.

Changes in exploration expenditures are likely to lag changes in metal prices because exploration activity in a particular year is the result of a budgeting process that took place in the preceding year. Budget allocations for a given year are therefore likely to reflect the metal prices and company profits of the preceding year.

To capture this relationship between exploration and metal prices, the NRCan yearly metals price index, lagged one year, was included in the estimating equation. This index is a Fisher Ideal Index, based on the prices of six metals - gold, silver, copper, zinc, lead and nickel. **Figure 3** shows the relationship between historical exploration expenditures by senior companies and the NRCan metals price index lagged one year.

Mineral exploration is a multi-stage process that usually proceeds over a relatively long period of time, as information is gathered from geological reconnaissance work, geological mapping, geophysical and geochemical surveying, trenching, diamond drilling, and so on. At various stages, this information is used by exploration companies to decide where to concentrate further exploration activity and, indeed, whether to proceed at all. If early stages of exploration are successful in discovering promising mineralization, the exploration company has a strong incentive to proceed with more detailed, and more costly, delineation drilling and analysis, thereby increasing the amount it spends on exploration. It can therefore be argued that exploration in a given period is also related to exploration spending in previous periods. To capture this relationship, a lagged dependent variable was included in the equation.

1.3.4.2 Results

Using data for the years 1969 to 1996, the statistical equation predicts that 1997 exploration expenditures by senior companies could amount to about $550 million. For junior companies, the equation predicts that exploration expenditures will reach about $310 million. For all companies, expenditures of about $860 million are predicted (**Figure 4**).

1.4 RECENT MINERAL EXPLORATION SUCCESS AND DISCOVERY POTENTIAL

Year after year, considerable sums of money are invested in mineral exploration in Canada. Although the ultimate measure of success of this intensive exploration effort lies in the quantity of mineral commodities actually produced by Canadian mines, the number, size and quality of recently discovered deposits provide a good indication of Canadian exploration success and discovery potential.

An analysis of Canadian mineral exploration success, for all types of metal deposits, over the period 1946-90 revealed that the quantities of metal discovered in Canada during the three year periods of 1982-84 and 1985-87 were relatively low compared to earlier three-year periods covered by the study. However, there was significant improvement in the three-year period 1988-90 and beyond.

A comprehensive discovery analysis has not yet been done for the 1991-93 and 1994-96 periods. However, with the discovery of the major Voisey's Bay nickel-copper-cobalt deposit and a considerable number of diamond deposits, along with other types of deposits, the period 1994-96 currently appears to have a greater value of discoveries than any three-year period since the 1970s.

Since early 1994, production decisions have been made for more than 60 Canadian metal deposits that were discovered between 1963 and 1990. It is clear that Canada's mineral exploration success of recent years and discovery potential in the near future bode well for the future of mining in Canada. Some of the more significant discoveries and developments, and their impact on Canada's position as a world producer of minerals and metals, are summarized below.

1.4.1 Nickel

The Voisey's Bay nickel-copper-cobalt deposit was discovered in 1994 and is currently believed to contain

more than 150 million tonnes (Mt) of ore. It represents the largest Canadian nickel discovery since the deposits of the Thompson Nickel Belt in Manitoba were discovered in the 1950s and early 1960s. The Pipe Deep and William Lake deposits, both located in the Thompson Nickel Belt, were also discovered in 1994.

The discovery of these promising nickel deposits, along with the high-grade Victor-Nickel Rim copper-nickel deposit (discovered in Sudbury in 1990), the development of nickel-copper mines on the Raglan property in Québec's Cape Smith Nickel Belt, and a major underground exploration program at the Montcalm nickel deposit in Timmins that may lead to production, will enable Canada to regain its position as the world's leading nickel producer.

1.4.2 Diamonds

At least 15 diamond deposits with mining potential have been discovered in Canada in the past five years. In addition to the BHP/Dia Met diamond project (described in Section 4), as many as three other diamond projects could reach production within a few years. The current high level of exploration activity for diamonds in Canada raises the likelihood of further discoveries. Hence, Canada appears destined to become one of the world's foremost diamond producers.

1.4.3 Uranium

Three major new uranium mining projects are awaiting development in Saskatchewan: the McArthur River, Cigar Lake and Midwest projects. The world-class Cigar Lake and McArthur River deposits are considered to be the world's two greatest uranium discoveries ever.

Despite a planned increase in uranium production from Australia, Canada is likely to remain the world's foremost producer of uranium for the foreseeable future.

1.4.4 Copper

Three porphyry gold-copper mines are currently being developed in British Columbia (Huckleberry, Kemess South and Mt. Polley). Although Huckleberry and Mt. Polley were originally discovered in the 1960s, it was additional exploration in more recent years that led to the discovery of the gold-rich zones that turned these known deposits into viable ones.

The development of new copper mines in British Columbia and the Yukon also seems likely. Overall, the copper from these new and anticipated mines, together with the copper that will be produced at Voisey's Bay and at Victor, should enable Canada to maintain its position as the world's third largest copper producer for the foreseeable future.

1.4.5 Gold

Canadian gold production reached an all-time high in 1991 with 175.3 t produced. Although production had declined to 146.4 t by 1994, it reached 150.9 t in 1995 and rose again to 164.1 t (preliminary) in 1996. If the gold price were to hover around its levels of early 1997, a number of new gold mines would be developed and new all-time records of Canadian gold production would be achieved in the near future.

1.4.6 Other Mineral Commodities

Canada's recent success in mineral exploration, discovery and production has not been restricted to metals and diamonds. Production from new coal mines, combined with production from existing coal mines, has resulted in record levels of Canadian coal output in recent years. The production of potash, salt and other minerals is also at near-record levels. In addition, recent discoveries have led to the opening of new graphite and garnet mines in Ontario, a wollastonite mine in Québec, and a new pumice mine in British Columbia.

Successful exploration has outlined still more quality deposits for these commodities. As well, recently discovered deposits of industrial and construction minerals at various locations offer additional development opportunities.

2. Diamond Drilling

2.1 INTRODUCTION

Diamond drilling is an essential component of exploration for nearly all mineral properties in Canada, from the anomaly investigation stage to the deposit delineation and deposit definition stages. This is why diamond drilling statistics constitute a valuable indicator of recent levels of Canadian mineral exploration activity.

2.2 OVERVIEW OF DRILLING ACTIVITY

2.2.1 Statistical Background

The Canadian Drilling Association (CDA) gathers monthly diamond drilling statistics from its member companies. Available CDA statistics cover about 50-60% of total Canadian contract diamond drilling activity. Although incomplete, they provide a reasonable and up-to-date indication of recent national mineral exploration trends. The CDA drilling statistics are depicted in **Figure 5** (monthly, 1985-96), **Figure 6** (quarterly, 1985-96) and **Figure 7** (yearly, 1973-96).

In addition, a comprehensive 23-year graph (**Figure 8**) depicts total Canadian contract drilling up to 1995, as reported annually to NRCan by drilling contractors and published in Statistics Canada's catalogue no. 26-201. As well, the federal-provincial survey of mining and exploration companies includes all metres drilled and expenditures reported by companies for their "own account" and contracted drilling work. Exploration and development drilling have been aggregated in the federal-provincial survey to allow a fair comparison with the other two sets of statistics (**Figure 9**). Mine-site development drilling (mainly underground) consists of drilling aimed at establishing replacement ore reserves at producing mines.

Although these three sources of statistics provide different annual results, the same overall trends are observable in the three surveys over the period 1989-95.

2.2.2 Canadian Drilling Association Results

As can be seen from **Figure 6**, each of the four years (1988, 1989, 1990 and 1991) exhibited a similar pattern of diminishing diamond drilling throughout the year, with metres drilled in the first quarter of each year higher than metres drilled in the final quarter of the previous year. This general quarterly decline in drilling throughout the years continued until the third quarter of 1992 when metres drilled in the fourth quarter increased relative to the third quarter.

From 1988 to 1996, drilling peaked consistently during the first quarter. The explanation is twofold: (1) in each of those years, flow-through share funds from the previous year were carried over into January and February; and (2) much of the drilling must be done during the winter months on frozen lakes and on areas of muskeg that are generally inaccessible to drilling equipment at other times of the year. The former is likely to become less relevant because the "look-back" period for flow-through-share-financed exploration was extended from 60 days to 365 days in the 1996 federal budget. As a result, exploration companies now have more time in which to spend flow-through share money that was raised in the previous calendar year.

The general pattern of decreasing quarterly drilling throughout the year in 1988, 1989, 1990 and 1991 contrasts with the pattern of 1986 and 1987 when diamond drilling levels in the second half of the year were higher than in the first half because of the increasing availability of flow-through share funding during the heyday of the Mining Exploration Depletion Allowance (MEDA).

Total metres drilled in 1993 were considerably higher than in 1992, with further increases in 1994 and 1995 (**Figure 7**). Although incomplete, the metres drilled during the first three quarters of 1996 are 11% higher than the metres reported for the same period in 1995.

2.2.3 Exploration Drilling

In 1995, 2 641 649 metres (m) of surface exploration drilling were completed in Canada, up by 18% from the 2 231 651 m drilled in 1994. Diamond drilling (2 371 880 m) constituted 90% of the total metres of surface drilling. Ontario, Québec, the Northwest Territories and British Columbia, in decreasing order of importance, jointly accounted for 70% of total surface drilling activity (**Figure 10**).

Underground exploration drilling (both diamond drilling and other types of underground exploration drilling) totalled 631 648 m, up by 4% from the 608 194 m drilled in 1994. Together, Ontario (213 293 m), Québec (211 270 m) and Manitoba (121 130 m) accounted for 86% of total underground exploration drilling.

Senior companies reported 68% of the total metres of surface diamond drilling and junior companies reported 32%. Some 99% of underground diamond drilling was reported by senior companies (**Figure 10**). Of the total surface metres drilled (diamond drilling), 52% was undertaken in the search for precious metals, 31% for base metals, 9% for nonmetals and 6% for uranium. Underground drilling was carried out mainly in the search for precious metals (68%) and base metals (31%). About 40% of annual field exploration expenditures is normally dedicated to drilling.Current dollar costs per metre of exploration drilling in Canada can be calculated for the period 1985-95 inclusive, using data from the federal-provincial survey of mining and exploration companies (**Table 1**). Such data are not available for years prior to 1985. These costs may exceed the actual amounts paid to drilling contractors, as some companies may have included costs associated with drilling such as geological logging and assaying of core. These average drilling costs include both surface and underground drilling expenditures; surface drilling costs are normally significantly higher than those for underground drilling.

3. Claim Staking and Exploration Intensity

3.1 INTRODUCTION

The area of new mineral claims staked in Canada in 1996 (**Table 2**) totalled some 13 million hectares (ha), 16% less than that staked in 1995 but still a large area relative to the ones staked in years preceding the discovery of diamonds in 1992 at Lac de Gras in the Northwest Territories.

3.2 NEW CLAIMS STAKED AND CLAIMS IN GOOD STANDING

In 1996, the area of new mineral claims staked in Alberta was 5.3 million ha, more than three times that staked in 1995; in Nova Scotia it was almost 425 000 ha, or more than double the area staked in 1995. Staking was also up somewhat in New Brunswick, Ontario, Saskatchewan, British Columbia and the Yukon.

Mining recorders have advised that there was: in Alberta, a renewed interest in staking for diamonds; in Saskatchewan, renewed interest in uranium staking and, while diamond staking was up compared to 1995, it was still well below previous high levels; in Nova Scotia, an interest in staking for kaolin and gold; in New Brunswick, a staking rush for base metals in the Plaster Rock area; in Ontario, increased staking activity in the Temagami area; and in the Yukon, continued staking around the Wolverine deposit in the Finlayson Lake area. The areas staked in Alberta (40% of the Canadian total), the Northwest Territories (22%) and British Columbia (9%) represent a combined area of 9.4 million ha, or 70% of the total area staked in Canada in 1996.

The areas staked in 1996 were down by 93% in Newfoundland and Labrador, by 65% in Québec, by 23% in the Northwest Territories, and by 6% in Manitoba. The declines in Newfoundland and Labrador and in Québec were mainly due to a relative slowdown when compared to the 1995 staking rush that followed the Voisey's Bay discovery. In the Northwest Territories, most of the desirable areas for diamond exploration have already been staked.

The total area occupied by claims in good standing in Canada amounted to approximately 4.0% of the

total Canadian land mass in 1996 compared to 5.4% in 1995 (**Table 3**). The difference can be explained, in large part, by the dropping of claims staked in the search for diamonds in Alberta and the Northwest Territories. The situation could reverse in 1997, as early indications point to a staking rush of even greater proportion than in 1995 for Alberta. In 1996, Newfoundland and Labrador, Nova Scotia and Alberta were the provinces/territories with the largest proportion of their land mass occupied by claims in good standing.

3.3 EXPLORATION INTENSITY

There is a considerable variation in the level of exploration expenditures across Canada's provinces and territories. For example, 1996 exploration expenditures amounted to $183.2 million (preliminary) in the Northwest Territories, but were essentially zero in Prince Edward Island. There is also great variation in the land areas of individual provinces and territories. The smallest, Prince Edward Island, has a land area of 5560 km 2 while the largest, the Northwest Territories, covers 3 426 320 km 2 . Because of the varying land areas, it can be misleading to compare provinces and territories on the basis of exploration expenditures alone.

A more complete measure of exploration intensity can be obtained by looking at exploration expenditures per unit of area. Newfoundland and Labrador, New Brunswick and Ontario recorded the greatest exploration expenditures per hectare in both 1995 and 1996 (**Figure 11**). Alberta received the lowest spending per hectare for both years. The significant increase in new mineral claims staked in that province in 1996 may contribute to an increase in the level of exploration expenditures per hectare.

Although not all exploration expenditures in any jurisdiction are spent on existing mineral claims (some expenditures are incurred on unclaimed land or on mining leases), exploration expenditures per unit of area of mining claims in good standing still constitute another useful measure of exploration intensity. The data for 1995 (**Figure 12**) show that Québec, New Brunswick and Ontario enjoyed the highest levels of general exploration expenditures per hectare of claims in good standing. For 1996, Québec remained in first place ahead of Ontario, which showed significant improvement, while New Brunswick dropped to third place. Once again, Alberta was at the lowest end of the spectrum although it experienced the most dramatic improvement in spending, in percentage terms, per hectare of claims in good standing. For Canada as a whole, exploration spending per hectare of claims in good standing increased substantially from about $13/ha in 1995 to about $23/ha in 1996. This increase can mostly be explained both by the smaller area covered by claims in good standing in 1996 and by an increase in exploration expenditures in the same year.

4. Exploration for Diamonds in Canada

4.1 EVOLUTION OF DIAMOND EXPLORATION IN CANADA

The discovery, in late 1991, of a diamond-bearing kimberlite of apparent economic potential at Point Lake, near Lac de Gras in the Northwest Territories, initiated an almost immediate staking rush of unprecedented magnitude, mostly in the Northwest Territories and Alberta and, to a lesser extent, in Saskatchewan. Within a short period of time, a large number of companies were exploring for diamonds in many parts of Canada.

The diamondiferous kimberlite at Point Lake was not the first diamond discovery in Canada. A loose 33-carat (ct) diamond was found, some time before 1920, during the excavation of a railway cut near Peterborough, Ontario. That diamond was rough, broken and of little value as a gem. In 1971, the Jarvi diamond, a loose 0.25-ct gem-quality diamond, was found in glacial gravels in an esker near Timmins, Ontario.

Twice during the 1960s, small diamonds were reported to have been found in glacial gravels to the east of Prince Albert, Saskatchewan. Some believed these reports to be hoaxes but, since 1988, more than 40 kimberlite pipes have been found in that area, near Fort à la Corne. The small diamonds that were found in the 1960s may well have been indicator minerals for the Fort à la Corne kimberlite pipes. None of the 40 pipes found near Fort à la Corne have yet proven to be economically mineable, although many are diamondiferous.

Serious exploration for diamonds in Canada began in the 1960s. The South African company De Beers Consolidated Mines Ltd. has been continuously exploring for diamonds in Canada ever since. De Beers

and other companies have discovered diamond pipes in various localities, chiefly in Ontario and Québec, but also on Somerset Island in the Canadian Arctic (where Cominco has also found some kimberlites). So far, none of these pipes appear to have diamond contents that are of ore grade.

In recent years, some very small diamonds have been found in glacial and stream gravels in Alberta; however, their sources are unknown. They could have been carried south for many hundreds of kilometres by glaciers, but they could have also come from more local kimberlite intrusions. In early 1997, Ashton Mining of Canada Inc. discovered eleven kimberlite pipes on the Buffalo Hills property near Hinton, Alberta. At least six of these pipes are diamondiferous, but larger samples will be required to determine whether they are of potential economic significance.

In late 1996, BHP Minerals Canada Ltd. received final approval for mining five diamond ore-bodies in the Lac de Gras area. Initial diamond production is expected in the fall of 1998. The nearby Diavik project is the site of advanced exploration and is expected to produce some of the world's highest diamond values per tonne of diamond ore. Preproduction is likely to begin within the next few years. Lytton Minerals Ltd. mined a 15 000-t underground bulk sample from the JD/OD-1 kimberlite on its Jericho property not far from the Lupin gold mine, and is currently processing the sample to determine diamond content and values.

Mountain Province Mining Inc., Camphor Ventures Inc. and Glenmore Highlands Inc. have been exploring the AK-CJ claims, to the southeast of Lac de Gras, where the AK-5034 kimberlite has yielded attractive diamond values. Monopros Limited, a wholly owned subsidiary of De Beers, is now the project operator. Monopros can earn up to a 60% interest in the property, including the AK-5034 pipe, when commercial production begins.

4.2 STATISTICAL SUMMARY

Expenditures dedicated to exploration for diamonds in Canada by senior and junior companies since 1989 are shown in **Figure 13**.

The higher diamond exploration expenditures in 1993 and subsequent years reflect not only an increase in the number of companies exploring for diamonds and an increased number of active diamond exploration projects, but also the high costs of underground and large-diameter drill-hole bulk sampling of various diamondiferous kimberlite intrusions discovered since 1991 in the Lac de Gras area. For example, the current two-year exploration program on the Diavik project of Aber Resources Ltd. and Kennecott Canada Inc. is expected to cost some $85 million. This amount includes the cost of a prefeasibility study. Even more has been spent on the bulk sampling of kimberlites on the BHP-Dia Met property.

Over the five-year period 1993-97, a total of $644 million will have been spent on diamond exploration in Canada, representing about 18% of total exploration expenditures for all non-petroleum mineral commodities in this country over the first four years and 14% in 1997. Company spending intentions for diamond exploration in Canada for 1997 are about $124 million, down somewhat from $147 million in each of 1995 and 1996 (**Figures 13** and 14).

In 1995, there were 61 companies operating exploration projects for diamonds in Canada, 84% of them being juniors. That number was down significantly from the 102 companies reported in 1994. In each of 1996 and 1997, about 45 to 50 companies (approximately 75% of them juniors) were active in diamond exploration in Canada (**Figure 15**). Despite the high proportion of junior project operators, roughly 65% of total 1996 and planned 1997 expenditures were reported by senior company project operators, compared to a 73% contribution by senior operators in 1995 and 55% in 1994.

In 1995, four major project operators, active mainly in the Northwest Territories, accounted for about 82% of total Canadian diamond exploration expenditures. In each of 1996 and 1997 (company spending intentions), five major project operators accounted, or will account, for about 75% of all exploration expenditures for diamonds in Canada. The advanced exploration projects of four of them, all in the Northwest Territories, are described in Section 4.3.

4.3 ADVANCED PROJECTS

In April 1997, there were over 600 diamond exploration properties in Canada, about the same number as in November 1995. The provincial/territorial distribution of these properties in April 1997 was almost

identical to that in November 1995 (**Figure 16**). More than one third of these properties were located in the Northwest Territories. Saskatchewan, Ontario, Alberta and Québec are the other principal provinces/territories for diamond exploration. There was also some limited activity in the Yukon, British Columbia, Manitoba, and Newfoundland and Labrador.

Fifteen individual diamond deposits on four separate properties, all of them in the Northwest Territories, currently appear to have the highest production potential of all Canadian diamond deposits. These properties are: Lac de Gras (currently being prepared for production), Diavik, Jericho and AK. Each of these properties is described below in more detail.

The omission of other diamond properties from this list does not imply that they lack economic potential, but only that currently published information does not clearly indicate that such properties appear to have significant economic potential. Publicly available diamond content and value information for diamondiferous kimberlite deposits on the four properties is provided in **Figure 17** and **Table 4**. The reported diamond content and values for several of the kimberlites are based on samples of only 100 t or so and are likely to change as results from larger bulk samples become available.

4.3.1 Lac de Gras

In 1996, exploration continued on the Lac de Gras property of BHP and its associates in the Northwest Territories. A total of 77 kimberlite intrusions have been found on this property, up from 66 at the end of 1995. At least 42 of these kimberlites are known to contain diamonds. Twenty of them have been bulk-sampled. Exploration for additional kimberlites and mini-bulk sampling of diamondiferous kimberlites continue, but at a considerably lower rate of expenditure. By the time mine development began in late 1996, BHP had spent some $200 million on the property. Much of this was on exploration, on bulk sampling using large-diameter diamond drilling and/or underground workings, on feasibility studies, and on environmental studies.

Table 4 lists the available bulk sample results from each pipe currently scheduled for mining (Panda, Misery, Koala, Fox and Sable) and for the Jay, Leslie and Pigeon pipes, which are not yet scheduled for mining but are likely to be mined eventually. **Table 5** lists mining ore reserves for the five pipes that are currently scheduled for mining.

During 1995, bulk samples from four other pipes on the same property (Cub, Grizzly, Arnie and Mark) were also tested, but the diamond content and initial quality assessment of the diamonds recovered indicated that each of these four pipes was of insufficient economic value to warrant additional work at that time. This has also been the case for several other pipes from which small bulk samples were taken in earlier years. It would be surprising if at least some of these less attractive pipes were not further evaluated as mining proceeds and the need for additional ore becomes a concern.

The BHP diamond project will process 9000 tonnes per day (t/d) of ore for the first 9 years of production, increasing to 18 000 t/d in year 10. The average value per tonne of each of the Panda, Misery and Koala deposits is in excess of US$100/t (**Table 4**), which indicates that these three deposits appear to be among the world's highest-grade diamond deposits in terms of per-tonne values (**Figure 18**). The Sable deposit contains US$63/t of diamonds and the Fox deposit US$34/t. The Leslie deposit, now replaced in the mining schedule by the higher-grade Sable deposit, will probably be mined later. Projected annual revenue from this project appears to be in the range of C$400 million-$500 million over the currently scheduled 17 years of production. The higher production tonnage rates from year 10 on will compensate for the lower per-tonne diamond values of the Sable and Fox pipes, which are scheduled to begin production in years 10 and 11 respectively so as to provide a relatively constant annual diamond production value during the 17 years. Mining rates for each of the above orebodies are determined by ore grade, diamond quality and specific ore-processing characteristics. A total of approximately 78 Mt of ore, of which 85% is currently defined as proven or probable reserves, and approximately 508 Mt of waste rock are scheduled to be mined over the 17-year initial life of the project.

4.3.2 Diavik

The Diavik project is operated by Diavik Diamond Mines Inc., which has a 60% interest in the project. The company is a wholly owned subsidiary of the large multinational mining company RTZ-CRA of London, England, as is Kennecott Canada Inc., which previously held the 60% RTZ-CRA interest in the property. The remaining 40% of the project is owned by Aber Resources Ltd. of Vancouver, British Columbia. Aber has put up 40% of the costs of exploring the property and retains the right to market its

40% share of diamond production.

A total of 45 kimberlite pipes have been discovered on the Diavik property, of which at least 13 are known to contain diamonds. Four pipes, A-154 South, A-154 North, A-418 and A-21, currently appear to be the most promising and are described on the following pages.

A prefeasibility study of the Diavik project will be completed in the fall of 1997 and a formal feasibility study will begin in the fourth quarter of 1997.

Pipe A-154 South

Notable results were obtained by drilling the A-154 South kimberlite, including the recovery of a 1.76-ct diamond. A one-kilometre-long decline was driven to a depth of 155 m, a 2900-t bulk sample was taken during the winter of 1995/96, and a total of 12 800 ct of diamonds were recovered for valuation. A sample representing roughly one half of the 12 800 ct, valued by experts in Antwerp on the basis of early 1997 market conditions, yielded a value of US$67/ct, which suggests a value of US$63/ct for the entire bulk sample (**Table 4**). These data indicate that the A-154 South kimberlite has an average diamond content of 4.4 ct/t and a value of US$278/t. The estimated resource is 12 Mt to a depth of 400 m with as much as 20 Mt to a depth of 650 m. The A-154 South deposit is one of the world's highest per-tonne valued diamond deposits (**Figure 18**).

Pipe A-418

A 3000-t underground bulk sample was taken from the A-418 kimberlite using the A-154 South decline for access. The proximity of the A-154 North and A-418 kimberlites (both within 750 m) to the A-154 South kimberlite has facilitated underground sampling of these two kimberlites. At the time of writing, the processing of the A-418 bulk sample was in progress at a pilot plant in Yellowknife, Northwest Territories. The rough diamonds were to be sent to Perth, Australia, for cleaning, sorting and initial valuation, and then on to Antwerp for valuation by Aber's consulting diamantaire. A 62.3-t sample from the A-418 kimberlite yielded 247.5 ct of diamonds (4.02 ct/t), valued at US$64.10/ct, or US$258/t.

A June 5, 1997, press release by Aber indicated that, by that date, 1490 dry tonnes had been processed and yielded 4217 ct of rough diamonds. The 2.83 ct/t is consistent with the grade that had been determined by large-diameter core drilling for the section of the pipe where the sample drift is located. Unlike pipe A-154 South, which is relatively homogeneous, pipe A-418 displays internal variations in both rock character and grade. This is evidenced by the fact that, of the 4217 ct recovered so far, 1898 ct came from 306 t of the 1490 t of kimberlite processed to date. Aber said that although additional refinement of resource modelling is needed, this higher-grade section is believed to comprise a large proportion of the upper part of the pipe. The 4217 ct of diamonds recovered were valued in June 1997 by Aber's consulting diamantaire at an average of US$60/ct, with the range of diamonds assessed as being of high quality and readily marketable.

The grade estimate for the entire pipe, determined by Diavik Diamond Mines Inc., remains at 4.0 ct/t, based on nine large-diameter core holes drilled to a depth of approximately 400 m. The A-418 deposit is estimated to contain 5.8 Mt to a depth of 250 m with a potential of 15-20 Mt to a depth of 650 m.

Pipe A-154 North

A mini-bulk sample of 71.72 t from the A-154 North kimberlite yielded 156.8 ct of diamonds (2.19 ct/t) valued at US$35.10/ct, for a value of US$77/t. A-154 North has a preliminary resource of 5.3 Mt, to a depth of 250 m, with a potential of 15 Mt to a depth of 650 m. Recent drilling results have increased the kimberlite tonnage to 10 Mt to a depth of 400 m. No additional testing of this pipe is planned because the upper one third of the pipe would be mined from the same open pit as A-154 South at minimal additional mining cost.

Pipe A-21

A 6.9-t mini-bulk sample from one large-diameter drill core sample yielded 3.1 ct/t. The pipe contains an estimated 5 Mt to a depth of 400 m. Five additional large-diameter core holes have recently been drilled, with the core to be processed at the Yellowknife plant in April 1997 and the diamonds to be sent to Perth, Australia, for cleaning, sorting and initial valuation. These holes produced 23.61 dry tonnes of kimberlite

that returned an average grade of 2.73 ct/t.

4.3.3 Jericho

Lytton Minerals and its various partner companies have discovered at least six diamond-bearing kimberlite pipes on their various properties in the Northwest Territories.

A 94.5-t mini-bulk sample of kimberlite core from six delineation holes drilled into the JD/OD-1 kimberlite, owned by Lytton and New Indigo Resources Inc., yielded 138 ct of diamonds (1.46 ct/t) (**Table 4**). Early valuations averaged US$95/ct (US$139/t). The pipe is estimated to contain a resource of 15 Mt to a depth of 750 m.

A 15 000-t bulk sample was extracted from the JD/OD-1 pipe between the fall of 1996 and early 1997 from a 257-metre-long decline, driven into the pipe at a depth of 75 m. The bulk sample material was transported by winter road to Lytton's diamond sampling plant at the Lupin gold mine site. Lytton is processing the bulk sample, with full results expected to become available by mid-1997. These results could form the basis of a feasibility study on the Jericho project. Lytton has 12.5 million acres of mineral claims in the Northwest Territories, approximately 30% of the area of the entire Slave Craton, which is the area of very old Precambrian rocks that hosts all of Canada's significant diamond discoveries to date. The company recently signed a joint-venture exploration agreement on this property with Kennecott Canada Exploration Inc. (wholly owned by the large multinational mining company, RTZ-CRA) and Ashton Mining of Canada Inc. (RTZ-CRA and Ashton jointly own the large Argyle diamond mine in Western Australia).

In early June 1997, Lytton and New Indigo announced that 10.53 t of kimberlite from the JD/OD-3 kimberlite, located under a small lake that is approximately 7 km west of JD/OD-1, had yielded 7.34 ct of diamonds, for a grade of 0.697 ct/t. Delineation to date has defined a nearly circular pipe containing a preliminary 10.5 Mt to a depth of 350 m. Evaluation of the JD/OD-3 pipe continues.

4.3.4 AK

On the AK property, 150 km southeast of Lac de Gras, Mountain Province Mining Inc. (50%), together with its partners Glenmore Highlands Inc. (40%) and Camphor Ventures Inc. (10%), has drilled the AK-5034 kimberlite pipe that was discovered in 1995. Drilling done to date has indicated an estimate of 18.3 Mt of diamondiferous kimberlite to a depth of 300 m. A mini-bulk sample of 104 t of this kimberlite, taken during the early winter of 1995/96 using a large-diameter diamond drill, yielded 2.48 ct of diamonds per tonne. The need for, and extent of, further sampling of the AK-5034 pipe is being reviewed by De Beers' wholly owned subsidiary, Monopros Limited, and the diamonds that were recovered from the mini-bulk sample have been shipped to Johannesburg, South Africa, for evaluation and analysis.

In February 1997, Mountain Province was of the opinion that a diamond pipe of such size and grade in this remote locality is unlikely to be viable by itself, and that two or three pipes, totalling perhaps 50 Mt of ore, may be needed. For this reason, the current exploration program in the vicinity is being aimed at the discovery of additional diamondiferous kimberlite pipes so that bulk sampling and feasibility studies can (hopefully) be carried out more economically on several pipes at the same time. Mountain Province has recently raised $13 million to finance diamond exploration work in the Northwest Territories, and Glenmore Highlands has raised $4.65 million. In early March 1997, Monopros appeared to have become a joint-venture exploration partner on this property and the project operator, with the right to earn an interest of up to 60% in the property, including the AK-5034 deposit, upon commencement of commercial production (depending on financing arrangements).

4.4 COMPARISON OF RECOVERABLE GRADES AND VALUES OF CANADIAN DIAMOND DEPOSITS TO WORLD DIAMOND MINES

Available information concerning per-tonne recoverable diamond grades and values indicates that grades and values of the best 15 of the known Canadian diamond deposits compare favourably with those of world diamond mines (**Figures 18** and **19**).

4.5 OUTLOOK

Diamond exploration continues at many properties across Canada. In addition to portions of the Northwest Territories, Saskatchewan and Alberta, extensive additional areas of Canada, chiefly in Manitoba, Ontario and Québec, that are underlain by rocks of Archean age and that are therefore highly favourable for diamond exploration have yet to be subjected to intensive exploration for diamonds.

Canada appears destined to become one of the world's major diamond-producing nations within a few years. With 15 attractive diamond deposits discovered in only five years, it is likely that more diamond orebodies will be discovered in the coming years. This suggests that Canada can look forward to a long future as a major world diamond producer.

5. Regional Outlook

5.1 INTRODUCTION

This section presents comments from provincial and territorial officials on recent exploration activity in their respective jurisdictions and gives an indication of what they expect for 1997. Some of the exploration expenditure data mentioned by the different provincial and territorial authorities may differ from those reported under Sections 1 and 6 of this report (official federal-provincial figures released by NRCan). The figures reported by Québec include expenditures by the Québec Ministry of Natural Resources that are excluded from all NRCan published totals and the junior/senior analysis is based on different criteria. The exploration survey for Saskatchewan is not based on the same set of definitions used in the national survey.

5.2 NEWFOUNDLAND AND LABRADOR

Overview

Expenditures on mineral exploration reached the unprecedented level of $91 million in 1996, primarily as a result of base-metal exploration in Labrador in the wake of the world-class discovery of nickel-copper-cobalt at Voisey's Bay. Annual expenditures since the discovery was announced in November 1994 are $71 million and $91 million in 1995 and 1996 respectively, with $73 million forecast for 1997; this compares with the average of $20.16 million per year for the time period from 1985 to 1994.

In 1996, 93% of mineral exploration dollars were directed toward base-metal exploration and 6% was directed toward precious-metal exploration; 83% of the 1996 dollars were spent in Labrador. Since 1995, most exploration efforts are being carried out by the junior sector and prospectors, with senior Canadian and international mining companies a close second. These trends are forecast to continue in 1997.

Claim staking in 1996 returned to a more typical level of 15 299 claims after the overwhelming 248 707 recorded in 1995. First-quarter 1997 claim statistics stand at 3872 claims staked and 168 357 claims in good standing.

The statistics in **Table 6** show the dramatic increase in exploration in Newfoundland and Labrador since 1995.

New Mines

Richmont Mines Inc. brought the Nugget Pond gold deposit into production in early 1997, on schedule and on budget, for an investment of $27 million including the purchase price. Richmont began commercial production at Nugget Pond on April 1, 1997, and will produce 46 000 oz of gold annually over the next four years.

Electra Mining Consolidated Ltd. purchased the Rambler tailings gold deposit in 1996 from Raymo Processing Ltd. Electra began production in June 1996 using a vat-leach process.

Atlantic Gypsum Resources brought the Bay St. George Fischells Brook gypsum deposit into production in July 1996. The material is used to manufacture gypsum wallboard in Corner Brook.

Ming Minerals Inc. installed a gold circuit at its Rambler mill in July 1996 and mined the Rambler Main gold deposit; it also began mining the Stog'er Tight gold deposit in October 1996, but the operation is temporarily shut down.

International Granite Corporation/Ebony Granite Limited started quarrying stone in mid-1996 from their respective Borney Lake "black granite" quarries in central Newfoundland.

Development Stage Projects

Voisey's Bay Nickel Company Ltd. continued to explore its Voisey's Bay deposit in 1996. Drilling to date indicates that the Ovoid deposit contains 31.7 Mt grading 2.83% nickel, 1.68% copper and 0.12% cobalt, and the Eastern Deeps deposit contains in excess of 50 Mt grading 1.36% nickel, 0.67% copper and 0.09% cobalt. Voisey's Bay Nickel registered the project for environmental assessment in January 1997 and plans to have its smelter/refinery complex operational in the year 2000. The smelter/refinery facility, to be located at Argentia, will produce 270 million pounds (lb) of nickel, 32 million lb of copper and 7 million lb of cobalt annually.

Roycefield Resources Ltd. began construction of surface facilities and underground development at its Beaver Brook antimony deposit in 1996. Located south of Gander, this operation is scheduled to begin production in mid-1997. Its current reserves are sufficient for Roycefield to produce about 5% of the world's antimony for the next 13 years.

Raymo Processing Ltd. extracted a 15 000-t bulk sample from the Pine Cove gold deposit on the Baie Verte Peninsula in 1996. The project has cleared environmental assessment. Full production of this deposit is scheduled for 1998. Reserves are sufficient for six years of production.

Burin Minerals is proceeding with efforts to arrange public equity financing to re-open the St. Lawrence fluorspar mines and mill. The preparation of a prospectus for a public share offering is expected to start in the first half of 1997. Production at St. Lawrence will be approximately 120 000 t per year, and letters of intent have been signed by customers covering approximately 90% of projected production during the first two years of operation.

Exploration

Noranda Mining and Exploration Inc., in a joint venture with Brunswick Mining and Smelting Corporation Limited, continued to explore the AND Charter Lands in central Newfoundland for base metals in 1996.

Celtic Minerals Ltd. discovered base-metal mineralization on its Hungry Hill property located near Millertown in central Newfoundland in 1996. Celtic has interpreted the geology to be equivalent to the Buchans River Formation, which also hosts the high-grade Buchans base-metal deposits.

Major General Resources Ltd. continued to explore its Rendell-Jackman property in the Springdale area in 1996. Gold reserves were further defined and new base-metal mineralization was discovered. Reserves to date stand at 508 000 t grading 18.45 g/t gold in the Rumbullion-Hammerdown zones and 269 200 t grading 6.98 g/t gold in the Orion zone.

Tapestry Ventures Ltd. and Noront Resources intersected 8.91 g/t gold over 2.56 m, 5.14 g/t gold over 0.5 m, and 1.81 g/t gold over 3.0 m in three drill holes at their Duder Lake-Birchy Bay property in 1996.

NDT Ventures Ltd. intersected 1.29% nickel, 0.91% copper and 0.11% cobalt at its project 43 located 6 km east of Nain, and 1.64% nickel, 3.50% copper and 0.08% cobalt at its project 46 located southeast of Nain.

International CanAlaska Resources Ltd. discovered gold mineralization grading from 1.09 to 18.9 g/t gold from grab samples taken 10 km south of the Voisey's Bay deposit.

Donner Resources Ltd. and Teck Exploration entered into a joint-venture agreement to explore their Voisey's Bay South property. Expenditures are forecast to be approximately $5 million in 1997.

Rockhopper Corporation announced the discovery of gem-quality sapphires on its St. Lewis property in southern Labrador during 1996. Rockhopper Corporation optioned this property to Cartaway Resources Corporation. Plans for 1997 include geological mapping, sampling, and a stratigraphic diamond drill program.

Government *Incentives*

A total of $76 000 has been allotted by the Government of Newfoundland and Labrador for the 1997/98 fiscal year to provide grants to local prospectors.

The Mineral Regulations were amended in 1996 to allow individuals to be designated as genuine prospectors. This designation is valid for a five-year period and allows the genuine prospector to stake five licences for a total of 30 claims in each calendar year without the requirement of posting a security deposit of $50 per claim.

5.3 NOVA SCOTIA

Overview

Expenditures for mineral exploration rose significantly in 1996 with an estimated $5.7 million spent on exploration, more than double 1995's figure of $2.8 million. This represents the highest expenditure level since 1990 (**Table 7**, **Figure 20**). Exploration expenditures are forecast to increase again in 1997 to $6.7 million. This represents a 16% increase over 1996 and the third consecutive year of increased expenditures.

Similarly, staking activity increased significantly with an estimated 30 400 new and reissued claims (492 115 ha) being staked in 1996, up 85% from the year before and the greatest total area under licence since 1988. The number of new claims that were staked increased to approximately 19 500 (315 666 ha), the highest level of new staking since 1987. While the number of new and re-issued claims under licence remained in the 30 000 range (485 640 ha) for the first part of 1997, staking is expected to drop somewhat by year-end to approximately 25 000 claims (404 700 ha) as a number of companies move to consolidate larger holdings staked the year before.

The amount of exploration drilling in 1996 was also up over 1995, with the completion of an estimated 9000 m compared to roughly 8000 m the year before, a 12% increase. Exploration drilling is forecast to increase moderately in 1997 to roughly 12 000 m.

Exploration during 1996 was predominantly carried out by junior mining companies, aided by a generally better investment climate and improved provincial mining tax incentives implemented the year before. These improvements, aimed at stimulating investment in the province's mining industry, are described below:

- The 4% health services tax (non-renewable resources sales tax) on equipment used in the exploration, production and primary processing of mineral commodities was removed.
- The existing tax credit system was improved to help attract private sector venture capital for mineral exploration and development. A personal income tax credit of up to $9000, or 30% of the first $30 000, is now available for investors in new share issues of eligible companies. This is up significantly from the previous tax credit of 25% of the first $10 000, a maximum credit of $2500.
- The Government of Nova Scotia introduced a new corporate income tax credit to assist small companies in accessing equity markets by lowering the cost of issuing shares to the public. The first $100 000 of costs associated with the preparation of a public offering is now eligible for a non-refundable credit of 35%.

New Mineral Policy

The Nova Scotia government unveiled its new mineral policy entitled MINERALS - A Policy for Nova Scotia on November 6, 1996. The policy is designed to allow the government to adapt to changing circumstances and emerging concerns, and promotes integrated resource management as an important means of decision-making. The mineral policy was developed in consultation with members of the mineral industry, other resource interests, environmentalists, community representatives, citizens, and the three levels of government.

"One Window" Approval Process for Mine Development

The Government of Nova Scotia has undertaken a "one-window" approach to reviewing, permitting and monitoring mine development projects in Nova Scotia. This approach is intended to formalize how government departments involved with mine development activities will act collectively to streamline the review process for both the government and the mining industry.

This "one-window" approach facilitates an informed, timely and consistent review of new and existing mining projects in the province. The various departments involved in the process include the Nova Scotia Department of Natural Resources, the Nova Scotia Department of Environment, and the Nova Scotia Department of Labour, plus other provincial, federal and municipal government agencies as determined on a project-by-project basis. Government representatives from the departments of Natural Resources, Environment and Labour have formed a "one-window" standing committee that is responsible for the "one-window" functions of government.

Exploration Highlights

Exploration was undertaken for gold, base metals and industrial minerals in a variety of geological environments throughout the province. This activity was focused primarily on the evaluation of Cretaceous-age kaolin and silica sand deposits in central mainland Nova Scotia, gypsum deposits and carbonate-hosted lead-zinc mineralization in the Lower Carboniferous Windsor Group, gold deposits of the Lower Paleozoic Meguma Group, the gold and base-metal potential of Silurian-age metasediments and volcanics in the Cape Breton Highlands, and the base-metal potential of Precambrian volcanics and metasediments of the Stirling Belt in south-eastern Cape Breton Island. Several of these programs are either at an advanced stage of exploration or are proceeding to preliminary development work.

Kaoclay Resources Incorporated continued to evaluate the kaolin and silica sand potential of Cretaceous sediments in the Musquodoboit Valley area and has completed extensive drilling and sampling in recent months. The company also expanded its exploration program to include other areas of the province, including Cape Breton Island. Exploration and initial development work by Tusket Mining Limited has continued on a large gypsum deposit in the Murchyville-Elderbank area of Halifax County. The company plans to bring the property into production in the near future with reported reserves of over 300 Mt.

Savage Resources Canada continued a technical review of the former Westminer Canada Limited Gays River mine to evaluate the open-pit potential of the near-surface ore and to assess underground mining methods for the deeper ore. The company is currently in the process of dewatering the mine. The renewed interest in the property has also sparked interest in the base-metal potential of the Windsor Group carbonates on adjoining ground.

Tangier Limited Partnership continued an underground exploration program on the former Coxheath Gold Holdings gold property at Tangier to determine the feasibility of re-opening the mine. The company recently completed underground bulk sampling and test mining, and is currently in the process of conducting milling and metallurgical tests on the extracted ore.

Moose River Resources Incorporated initiated a detailed drilling program on the Moose River gold property during the fall to evaluate the potential for expanding the known reserves of the Touquoy zone. Preliminary results of the work to date indicate that the original reserves of 1.9 Mt grading 2.1 g/t gold have been significantly expanded.

Highland Range Minerals Limited continued to evaluate the gold and base-metal potential of Ordovician and Silurian metavolcanic and metasedimentary rocks in the Faribault Brook area east of Cheticamp. The company completed additional diamond drilling and detailed compilation work during the year. Phelps Dodge Corporation of Canada Limited is currently conducting an exploration program for base metals in the Stirling area along the southwestern extension of the Late Precambrian Fourchu Group (Stirling Belt) in Cape Breton. The company has concentrated its efforts in the immediate vicinity of the former Stirling mine property and near McKillops Pond to the southeast.

In addition, other exploration projects were completed during 1996 and work on a number of exploration programs that had been put on hold for the winter months is expected to resume in the spring or early summer of 1997. Overall, exploration activity has demonstrated a marked improvement in recent months,

and the expanded interest in the development of the province's varied mineral resources bodes well for the future of the mineral industry in Nova Scotia.

5.4 NEW BRUNSWICK

Mineral Statistics

The 1996 value of mineral production (including coal) in New Brunswick is estimated to be $924 757 862, representing a decrease of approximately 9% over the final value of $1 020 652 438 for 1995. This decrease can be attributed to reduced production in the metals sector, particularly at Noranda Mining and Exploration Inc.'s Brunswick Mining Division.Potash and zinc are the two major contributors to the value of mineral production and account for approximately 68% of the total.

The mineral sector generated provincial revenues of $24 031 908 in 1996. The metallic minerals tax and potash royalties contributed most of the revenue.

There were 21 503 mineral claims in effect on December 31, 1996 (Table 8). This is the second highest year-end total in 40 years.

The mining industry is the second largest industry in New Brunswick, directly employing over 4000 people, indirectly employing the same number, and contributing 7% of the province's GDP. The three major employers in the mining sector are base-metal, potash and peat producers.

Exploration Highlights

Mineral exploration forms the backbone of mineral development in New Brunswick. In 1996, exploration expenditures amounted to an estimated $16.1 million (Table 8), or a 27% increase over 1995 exploration activity in New Brunswick. Exploration is distinct from north to south and is described in that order in the following text.

Northern New Brunswick

The 1996 exploration expenditures in the northern half of the province were approximately $12 300 000, an increase of approximately $3 600 000, or 40%, over 1995. This increase is mainly due to the multiparameter airborne geophysical survey that was flown over the Bathurst camp.

Noranda Mining and Exploration Inc., which now includes Brunswick Mining and Smelting Corporation Limited, spent $7 670 000, or 62% of total expenditures, in the north. The next highest expenditure, $1 600 000, was incurred by Chapleau Resources Limited.

The number of claims in effect in northern New Brunswick was approximately 18 000, up 3000 claims, or 20%, over 1995, and the number of new claims recorded was double that of last year. A significant number of these claims were staked because of the multiparameter airborne survey.

Recently, Noranda made a discovery as a direct result of the airborne geophysical survey. Although the discovery is a long way from a mine, this new base-metal prospect, which is south of Caribou and north of Indian Lake, is in a part of the Bathurst camp where there were no known deposits and is therefore significant in this respect alone. To date, Noranda has spent over $600 000 on drilling this new prospect.

In 1996, the active major mining companies were Noranda Mining and Exploration Inc., Inmet Mining Corporation, BHP Minerals Canada Ltd., and Teck Exploration Ltd. Other major mining companies holding ground but not actively exploring were Granges Inc., Homestake Mining (Canada) Limited, and Falconbridge Limited.

In 1996, the active junior mining companies were Chapleau Resources Limited, Wild Horse Gold Corp., Stratabound Minerals Corp., NEBEX Resources Ltd., Major General Resources Limited, Eastmain Resources Inc., Connecticut Development Corporation, East West Caribou Mining Limited, Fancamp Resources Ltd., and Bathurst Exploration Ltd.

In addition to the activity in the Bathurst camp, significant exploration was also carried out for base metals around the Plaster Rock area by Chapleau Resources Limited and Wild Horse Gold Corp., and for copper-gold mineralization on the Aroostook-Matapedia zone (south of Campbellton) by Noranda Mining and Exploration Inc.

There is an interest in developing gypsum and related limestone resources in northwestern New Brunswick (Plaster Rock).

Southern New Brunswick

The focus of exploration in southern New Brunswick continued to be on platinum, palladium, gold, titanium, tin, potash and limestone, and there was also renewed interest in nickel.

The number of claims in effect in southern New Brunswick in 1996 was approximately 3500, an increase of 100 over 1995. Approximately 900 new claims were staked during the year.

Exploration work for metallic minerals was carried out by Wild Horse Resources Ltd., PGE Resources Corp., Foster Resources, Goldfluor Resources Ltd., Noranda Mining and Exploration Inc., and ADEX Mining Corporation.

Potash exploration was carried out by International Minerals Corp. (Canada) Ltd., on the Millstream deposit, and Potacan Mining Company (PMC). Potacan did a three-dimensional seismic survey over parts of its mining property in an effort to delineate additional ore reserves and pursue additional efficiencies in its underground mining operations.

An important limestone resource south of Sussex was investigated by Maritime Resources Research Ltd.

Development Highlights

Noranda Mining and Exploration Inc. continued the operation of the Brunswick No. 12 and Heath Steele mines. Due to a marked increase in seismic activity caused by the redistribution of ground stresses in the extensively mined No. 12 deposit, the production rate has been reduced to 9000 t/d from the previous target of 10 500 t/d.

East West Caribou Mining Limited received approval to proceed with mining operations at both the Restigouche open-pit and Caribou underground mine following the submission of detailed plans addressing various environmental issues. Production is now expected to begin in mid-1997.

Apocan Inc. officially resumed antimony mining at the Lake George deposit. After an auspicious start, the mine was plagued by problems with the hoisting system that eventually forced a temporary shut-down in December. The mine should be re-opening after metal prices improve.

ADEX Mining Corporation is carrying out a feasibility study for the development of the Mount Pleasant tin-indium-zinc-bismuth-tungsten deposit, which is expected to be completed by the end of summer 1997. Metallurgical testing was largely completed on the extraction of indium using bioleach technology and the flow sheet is being refined to optimize the recovery of other metals, particularly tin. Assuming the study's conclusions are positive, a 2000-t/d tin-indium mine could be operating by late 1998.

Potash production by the Potash Corporation of Saskatchewan Inc. (New Brunswick Division) and Potacan Mining Company (PMC) continued.

International Minerals and Chemicals (Canada) Global Limited (IMC Canada) is presently conducting a three-year exploration program on the Millstream potash deposit.

Exploration and Development Assistance Programs

Mineral Exploration Stimulation Program (MESP)

In order to provide stimulus to the exploration industry, the Province of New Brunswick continued its support of the prospector incentive program, called the Mineral Exploration Stimulation Program (MESP), by approving 35 grants totalling $50 000 in 1996. Similar funding will be available in 1997. The grants helped a number of prospectors to option their properties to exploration companies who rely on the prospectors to find areas of interest.

New Brunswick Exploration Assistance Program (NBEAP)

NBEAP is a federal-provincial assistance program aimed at assisting the junior mining sector in New Brunswick. The program was initiated in 1994 with an annual budget of $400 000, funded 65% by the federal government and 35% by the province under the Economic Diversification Agreement. The program provides assistance of 50% of project costs to a maximum of $40 000 per company. The program has received approval for three years for a total funding of $1.2 million. The program is a key component of the New Brunswick Mineral Resource Policy, which addresses the issue of declining mineral reserves. During the period 1994-96, a joint industry/government committee approved assistance to 41 projects with a total government funding of $870 600. Industry spent over $4 million on the above 41 projects.

Value-Added Mineral Processing (VAMP)

One of the major issues of the provincial Mineral Resource Policy released in 1993 was the desire to add value to mineral production in New Brunswick. In 1996, the province introduced a new program aimed at value-added products. The program is entitled Value-Added Mineral Processing (VAMP). The program provides direct assistance for projects that could lead to increased metal/mineral recoveries, as well as value-added products. Reasonable expenditures directly attributable to the projects, except for the acquisition of capital equipment, are considered eligible under VAMP. A total of $100 000 was allocated for this program in 1996. This program benefits the New Brunswick mineral industry with an added incentive to seek out value-added opportunities.

Major Studies and Programs

EXTECH II

EXTECH II is a five-year federal-provincial program running from 1994 to 1999 with a total funding of $6.8 million. The program focuses the latest geoscience concepts and technologies used on exploration for new base-metal (i.e., lead, zinc, copper) deposits in northern New Brunswick. This will be the last year of significant field work which, for the bedrock mapping people, will involve using the airborne results to sort out problem areas on the 1:20 000 scale geological maps. The geophysical maps, as anticipated, will greatly improve the understanding of the surface distribution of rock units in the Bathurst mining camp and ultimately permit better prediction of the three-dimensional distribution of massive sulphide-bearing units. Also, a geophysical atlas of the 20 most significant known massive sulphide deposits is being prepared, using the airborne results, supplemented by ground data. For exploration companies, this atlas will be analogous to a tourist guide of "what-to-expect" in the Bathurst camp. The target date for release of this atlas is January 1998 in conjunction with the Exploration '98 meeting in Vancouver.

NATMAP

The National Geoscience Mapping Program (NATMAP) is a four-year program running from 1993 to 1997 with a total funding of $750 000. It is a joint federal-provincial-university-industry program managed by the Geological Survey of Canada (GSC). The GSC provided funding of $250 000 to the New Brunswick Geological Surveys Branch for carrying out geological mapping and related studies on the Carboniferous basin. The geological mapping related to the project is complete. The report is in the final stage of completion. NATMAP recently extended the project for one more year, 1997/98, with funding of $79 000 for geocompilation of the basin at a scale of 1:250 000.

Geophysical Survey (Bathurst Camp)

The multiparameter airborne geophysical survey of the Bathurst camp is progressing very well. To date, 105 hard-copy maps and associated digital data have been released to the public. Over 1200 maps were sold to the public. As the result of, and in anticipation of, this new geophysical data, 4063 claims were staked. The average annual expenditure per claim in New Brunswick since 1990, in constant 1996 dollars,

is $680. Therefore, an increase of $3 374 800 in exploration expenditures can be attributed directly to the airborne survey. In addition, several exploration targets were found as a result of the new geophysical data. Exploration companies are either in the process of drilling these targets or planning to drill in the coming years (e.g., Noranda's showing). The survey created a positive attitude among the exploration community.

Geophysical and Geochemical Surveys (Restigouche)

The northeastern part of the province (i.e., north of the Bathurst camp) has been recognized to have potential for porphyry-skarn copper deposits similar to the deposits in Gaspé and large, low-grade Carlin-type (Nevada) gold deposits. The area has not been adequately promoted for serious exploration because of the lack of a comprehensive geoscience database. The Geoscience Branch proposed a multiparameter airborne geophysical survey and multi-element geochemical survey for this region. This project has two phases. Phase I involves an airborne geophysical survey similar to the one carried out over the Bathurst camp, and a geochemical survey over a test block. It is estimated to cost $540 000 and is expected to be completed by March 31, 1997. Evaluation of the results will include followup geological mapping by staff of the Minerals and Energy Division. If the results are positive, it is proposed that similar airborne geophysical and stream geochemical surveys be carried out over the entire region beginning in 1999. This second phase is estimated to cost $2 160 000, excluding A-base salaries. The province approved the funding for Phase I, which is being carried out by the province and the GSC.

Integrated Mineral Resource Management System (IMRMS)

The Minerals and Energy Division has been planning the development of an Integrated Mineral Resource Management System (IMRMS). The objective of the IMRMS is to make geoscience information available to exploration companies and the mining community in the most efficient and timely manner possible. It is designed to maximize the use of geoscience information collected in the past and ensure efficient and widespread use of both hard-copy and digital data sets. In the future, the system will provide currently unavailable digital data and improved access to the geoscience databases. An initial probing study on developing the system was carried out at a cost of $60 000 and was completed by March 31, 1996.

Geoscience Publication Indexing System (GPIS)

During the initial probing study on the IMRMS, it was identified that the development of a Geoscience Publication Indexing System (GPIS) will be a first priority. The GPIS was developed in 1996. It is designed to give users access to available information contained in the geoscience publications that are held by the Province of New Brunswick. The publications include New Brunswick publications (maps and reports), GSC publications (maps and reports), assessment files (industry reports), and bibliographies (scientific papers published in various journals). It is only an indexing system. All of the indexing information is contained in a large database and the GPIS helps users quickly sort through that database to find the information they need. It will also help users find information on all publications such as what maps are included and at what scales, where the reports are physically located, who wrote them, what type of information they contain, and how much they cost.

Sample and Analysis Subsystem

The Sample and Analysis Subsystem, as defined in the IMRMS study, will manage all data associated with physical samples collected from the field, as well as the results of any analysis performed on those samples. As a first step in constructing a Sample and Analysis database, the Geochemical Analysis System will bring the many files currently in existence containing geochemical analysis data into a common database. The system will provide the necessary input, inquiry and output functions for that database. The first phase of the project is expected to be completed by June 30, 1997.

5.5 QUÉBEC

Exploration Expenditures in Québec

According to preliminary data for 1996, exploration expenditures in Québec totalled $135.3 million. This represented a 2.8% increase over the $131.6 million recorded in 1995. Expenditures by junior companies increased substantially in 1996 to $42.5 million, a rise of 17% compared to the previous year. On the other hand, spending by senior companies decreased by 1.4% from $77 million to $75.9 million.

Exploration expenditures by the Government of Québec and public agencies amounted to some $17 million in 1996.

In addition, off-property exploration expenditures increased from $105.8 million in 1995 to $114.3 million in 1996, an 8% rise. On-property exploration expenditures in 1996 were 18.6% less than in 1995 (Table 9).

More than 80% of the exploration expenditures in Québec were directed to the Abitibi-Témiscamingue and Northern Québec regions.

The search for base metals expanded by 15% in 1996, while precious-metal exploration maintained its relative share. Prospecting for other minerals declined by about 25% in 1996.

Exploration Highlights in 1996

A promising copper-nickel-cobalt showing was discovered by the Québec Department of Natural Resources northeast of the town of Sept-Îles, near Volant Lake. The discovery led to major staking activity in this region, and drilling began in the first half of 1997.

There have been other successes as well in the Near North region over the past two years. Noranda's Tortigny copper-zinc deposit and SOQUEM's Clairy showing are examples of such discoveries. In the Eastmain Lowland sector, Barrick Gold Corporation has identified a gold-bearing pyritic horizon near Elmer Lake.

Windy Mountain Explorations Ltd. and Cochise Resources Inc. have announced a drilling program for the McLeod Lake deposit, west of the Upper Eastmain River. The mineralizations involved are of the porphyritic copper type.

Elsewhere in Québec, four discoveries are worthy of mention, belonging to SOQUEM in the Shortt Lake sector (gold); to Exploration Loubel in the southern Chibougamau sector (copper, gold); to Géonova, developing the Desjardins deposit in the Lebel-sur-Quévillon region (gold); and to Ressources Aur, involved in exploration work on the Bonnefond property in the Val-d'Or region.

Flow-Through Share Financing

Preliminary data show that, in 1996, financing raised in the capital markets for mining exploration in Québec amounted to $48.5 million. This is a 27% reduction from the previous year. In addition, a considerable proportion of the amount raised in Québec was directed outside of Canada, particularly to Latin America and Asia ($89.5 million).

Some $27.8 million was raised in the form of flow-through shares in 1996, an increase of 5% compared to 1995. The favourable economic context, as evidenced by the softening of the monetary policy, a strong gold price until mid-1996 and the absence of inflationary pressures, has certainly encouraged flow-through share financing in Québec, which also provides attractive tax benefits for investors (Tables 9 and 10).

Other Statistics on Exploration

According to preliminary data for 1996, diamond drilling totalled 1 077 042 m, up from a total of 1 018 039 m in 1995. In 1996, the number of claims recorded rose to 21 764, compared to 15 984 in 1995. This situation can be attributed primarily to the discovery of a promising copper-nickel-cobalt showing by the Québec Department of Natural Resources in the Sept-Îles region.

Tax Measures for Flow-Through Share Financing

The tax benefits associated with the Québec flow-through share regime are summarized below.

To the 100% tax deduction for Canadian Exploration Expenses (CEE) are added, where applicable, an additional deduction of 25% for exploration expenses incurred in Québec and a further deduction of 50%

if these are surface exploration expenses. In the latter case, the tax deduction totals 175% of exploration expenses incurred in Québec (**Table 10**). In addition, investors benefit from a tax exemption on deemed capital gains equal to the difference between the cost of acquiring a flow-through share and its adjusted cost base, which is deemed to be nil for tax purposes.

Investors may also claim the issuing expenses of flow-through shares when these expenses are renounced to them by the corporation. Accordingly, up to 15% of the proceeds of the issue may be claimed by an individual in the year of the financing, while the remainder may be spread over five years.

In 1996, the flow-through share regime was improved to allow junior exploration companies to conduct exploration work up to one year after the end of the year during which the funds were raised, while granting investors the tax benefit in the year of financing. This improvement was very well received by the mining industry, which had been asking for it for several years.

In the March 1997 Québec budget speech, the Minister of Finance announced that he was extending the tax incentives for mining and oil and gas exploration for two more years until December 31, 2000.

Other Mining Exploration Incentives

The Québec Department of Natural Resources provides technical and financial assistance for exploration.

In the area of technical assistance, the Department's geoscientific work helps companies identify areas with good mineral potential. The Department manages a geoscientific information data bank that incorporates more than 56 000 specialized documents concerning the results of exploration work carried out over the past 50 years. This is the EXAMINE data bank. In addition, the Department is continuing with the implementation of SIGÉOM (an integrated, geographically referenced geological and mining information system), which facilitates the access to and processing of geoscientific information. To date, the system can be accessed in five of the eight regional offices of the Department. SIGÉOM has been funded under the Canada-Québec Subsidiary Agreement on Mineral Development, which expires at the end of 1998.

The Department also manages various exploration assistance programs, particularly the Near North Mineral Exploration Program. This program was established by the Government of Québec in the fall of 1994, and facilitates the funding of exploration projects in the James Bay and North Shore regions. By the end of 1996, more than $3 million in financial assistance had been awarded under this program.

There is also the Geological and Mining Exploration Program managed by the Department under the Canada-Québec Subsidiary Agreement on Mineral Development. The funding available for this program had been used up by March 31, 1997. Since 1993, the program has contributed more than $6.2 million in financial assistance for prospectors, companies and regional mining funds.

In the Québec budget speech of March 25, 1997, financial assistance of $21 million over three years was announced to support the development of the Québec mining industry. Specifically, this financial assistance is intended to promote mining exploration in regions where the mineral potential is still unknown, that is, Québec's Near North and Far North areas, and to encourage partnerships with Aboriginal communities.

Following this announcement, the Department introduced, in April 1997, the Programme d'assistance à l'exploration minière du Québec (Québec Assistance Program for Mining Exploration) to continue the exploration assistance effort in Québec. This program is funded entirely by the Government of Québec and is intended for prospectors, exploration companies and the regional mining exploration funds.

In December 1996, the Programme de stimulation à l'investissement minier (Mining Investment Support Program) was cancelled to allow the creation of SODÉMEX - the Société de développement des entreprises minières et d'exploration (Mining and Exploration Companies Development Corporation). This is a limited partnership whose partners are SOQUEM and Capital d'Amérique CDPQ (a subsidiary of the Caisse de dépôt et placement du Québec). The mission of SODÉMEX is to participate in the development of the Québec mining industry by investing in junior exploration companies and active mine producers in Québec. In addition to the subscribed capital of $7 million, enabling it to acquire SOQUEM's portfolio of mining properties, the corporation will have at its disposal a further $10 million over the next five years ($2 million per year).

5.6 ONTARIO

Overview

Exploration activities increased dramatically throughout Ontario in 1996 and gold continues to be the primary commodity sought.

Ontario's preliminary forecast for general and mine-site exploration expenditures climbed to $177.9 million in 1996 from $129.7 million in 1995. The 1997 forecast for exploration dollars spent in Canada indicates that Ontario would lead the other provinces and territories at about $190 million. In 1995, 32% of general and mine-site field exploration dollars were spent on base-metal exploration and 63% on precious-metal exploration. In 1994, 30% of exploration dollars were spent on base metals and 68% on precious metals.

Senior mining companies' share of general and mine-site exploration expenditures is forecast to decline to 73% in 1997 from 74% in 1996 and 81% in 1995. Junior mining companies are expected to account for 27% of the $190 million in exploration expenditures in 1997, an increase from 26% in the previous year.

Mine-site development expenditures for 1997 are forecast at $233 million, an increase over the $215 million preliminary estimate for 1996 but below the $244 million in 1995. These data include overhead exploration expenditures. In 1995, 61% of mine-site development field expenditures were spent on precious-metal projects and 29% on base-metal projects. This compares to 67% for precious-metal projects and 22% for base-metal projects in 1994.

Of special note, there were 183 299 active claim units at the end of 1996, an increase of 11% from the 164 934 claim units reported at the end of 1995. This is the highest level ever attained in over 100 years of mining and exploration history in the province of Ontario. During 1996, a reported $37.3 million of exploration work was recorded for assessment credits, up from $21.2 million in 1995. Over 60% of the value of assessment was spent on diamond drilling.

Gold continued to be the exploration commodity of choice in Ontario during 1996. Base metals are the second most important commodity group in Ontario. The search for more diamonds continues in the Temiskaming, Wawa and James Bay Lowlands areas where major exploration programs were announced for 1997.

A flurry of activity, sparked by the re-opening of approximately 70% of the former Temagami Land Caution area, led to the staking of about 12% of the re-opened land. This area represents about 65% (800 km 2) of the high-mineral-potential ground.

New Mines

Battle Mountain Canada Ltd. and partner Teddy Bear Valley Mines Limited spent $55 million to put their Holloway gold mine into production. The mine began commercial production in October 1996. Reserves stand at 5.8 million tons grading 0.217 oz/ton gold.

Placer Dome Inc. and partner TVX Gold Inc. began commercial production in April 1997 at the Musselwhite property, 130 km north of Pickle Lake in northwestern Ontario. The mine is expected to produce 200 000 oz annually for the next 10 years.

Inco Limited put the McCreedy East project into production. Full production is scheduled for 1999. The overall cost is estimated at $194 million. The property, situated just west of Sudbury, is expected to produce at 2721 t/d of ore, or 10 205 t of nickel and 35 150 t of copper annually for 17 years.

Development Stage Projects

Echo Bay Mines Ltd. recently announced that it will bring its Aquarius gold property, 30 km east of Timmins, into production. Start-up of the open-pit mine is targeted for late 1998 with full commercial production planned for early 1999. The average annual production rate is expected to be 166 000 oz.

Current reserves are equivalent to an estimated seven years of production.

As a result of extensive underground and surface drilling, Royal Oak Mines Inc. increased reserves at its Pamour gold mine near Timmins by more than 1 million oz. The company plans to join two existing open pits to create a "Super Pit" with the potential for expansion. Royal Oak now estimates that its Ontario Division has a mineral resource of 120 Mt grading 1.9 g/t gold. This is equivalent to 7.3 million oz of gold, 2.8 million oz more than at the end of 1995. The Pamour mill, now operating at 3600 t/d, will be expanded to 13 600 t/d. The expansion should be completed by late 1998.

Royal Oak Mines Inc. plans to develop a large open-pit mine and underground operation at the Matachewan project. The company plans to spend about $100 million on this project with commercial production starting in October 1998. The mine is expected to operate for at least 10 years, producing 125 000 oz of gold annually from 1 825 000 tons of ore.

Inco Limited is developing a small open-pit nickel-copper mine north of Sudbury in Wisner Township. The company hopes to begin producing by the end of 1998 at the rate of 1000 t/d.

Madsen Gold Corp. continues its $8 million capital program to refurbish and explore the Madsen gold mine site near Red Lake. Underground drilling at the upper mine levels has increased the ore reserves in the "possible" category. The company hopes to begin production in 1997.

River Gold Mines Ltd., under an option agreement with VenCan Gold Corporation, began advanced exploration and plans to go into production with the Edwards deposit in the Goudreau area, north of Wawa. Stockpiled ore from the Edwards deposit will be processed at the mill of River Gold Mines. The annual production target is 40 000 oz.

Mine Expansions

Placer Dome Inc. is continuing work on its $70 million "depth development" program at its Campbell gold mine, near Red Lake. The new shaft will access recently defined deep reserves of 575 100 t grading 26.4 g/t gold. Total reserves are 4.1 Mt grading 19.2 g/t gold. The project is scheduled for completion by January 1999.

Inmet Mining Corp. will access the Pick Lake zone from its Winston Lake mine north of Schreiber. The additional reserve of 1.13 Mt averaging 1% copper, 17% zinc and 44 g/t silver will extend the operation to the year 2002. The cost of the project is $26.3 million.

Goldcorp Inc.'s Red Lake gold mine committed $10 million to a two-year surface and underground exploration program. A substantial ore zone was discovered at depth containing a preliminary resource of 46 654 500 g of gold.

At the Detour Lake gold mine, 220 km northeast of Timmins, Placer Dome Inc. recently discovered a new ore zone called the QK zone. A $7 million underground exploration program to delineate the zone has begun.

Falconbridge Ltd. is spending $35.4 million to modernize and upgrade the facilities at its Falconbridge complex.

Advanced Exploration Programs

Sudbury Contact Mines Limited reports that the shaft at its Victoria Creek project has reached a depth of 480 feet. Shaft sinking is expected to be completed to a depth of 1600 feet by the summer of 1997, followed by underground drifting on two levels and 10 000 feet of drilling. The main objective of the program is to confirm a mineral inventory of 1.5 million tons averaging 0.15 oz of gold per ton. Additional underground work is also planned to evaluate the remaining gold mineral inventory of an estimated 325 000 oz in the western portion of the deposit. Sudbury Contact is also a major player in the search for more Ontario diamonds and plans to spend $600 000 to test 55 targets in 1997.

Outokumpu Mines Ltd. is undertaking a $20 million program on its Montcalm base-metal project northwest of Timmins. The project involves the excavation of a 2500-m decline to the 300-m level and 20

000 to 25 000 m of underground diamond drilling. A bulk sample will be collected from the ramp for metallurgical testing.

Near Sudbury, Inco Limited is exploring the Victor nickel-copper deposit at a cost of $72 million. The deposit consists of two main zones between 1524 and 2134 m deep. Pre-development surface work will culminate with a feasibility study in 1999. If the study is positive, the Victor deposit could be in production by 2001. If negative, the entire site would be rehabilitated and revegetated.

The Fenn-Gib gold property near Matheson is held by Pangea Goldfields Inc., Homestake Canada Inc. and Cominco Ltd. Drill-indicated probable reserves total 40.6 Mt grading 1.33 g/t gold; 73% of these reserves lie within 250 m of the surface. The operators are investigating the feasibility of an exploration ramp to access the central zone above the 200-m level to conduct bulk sampling.

Exall Resources Limited and Glimmer Resources Inc. hope to bring the Glimmer project near Matheson into commercial production this year at an annual rate of 65 000 oz of gold. The company increased its reserve estimate to 275 100 oz of gold after a consultant examined the most recent drilling results.

Exploration

Corona Gold Corporation will spend $3 million conducting an exploration program on its Thunder Lake West joint-venture property located east of Dryden. The operator of the project, Teck Corporation, plans to complete 65 000 feet of diamond drilling and a 500-foot exploration decline.

Band-Ore Resources Ltd. will continue work on its main project in the Timmins area by drilling 92 000 m on the Thorne property where gold mineralization was encountered. This year's drilling program will include drill holes to confirm gold mineralization at depth.

Armistice Resource Ltd. intends to continue exploration work on its Armistice property near Matheson by conducting 100 000 feet of diamond drilling. The company is currently drifting east from its main shaft to develop nine drill stations.

Joint-venture partners Queenston Mining Inc. and Franco-Nevada Mining Corporation Limited will spend $2.1 million on the second stage of their exploration program along the Kirkland Lake-Larder Lake Break.

Nuinsco Resources Limited is continuing exploration work in the Rainy River area on its Richardson Township property. The company has identified a number of gold anomalies in till that will be drilled this summer. The company continues to explore the 17 zone for which a preliminary resource estimate was released.

Canmine Resources Corp. plans to spend $5 million this year exploring its 65 000-acre property at Werner Lake in the Kenora district. The company is developing an underground ramp to access the cobalt-bearing mineralized zone, which may contain significant amounts of copper, gold and platinum.

Pentland Firth Ventures Ltd. is continuing its exploration work in the Timmins area on the Marhill gold deposit, the East Wetmore property and the Ogden 43 property. The company is also exploring the Hammond Reef property near Atikokan.

Holmer Gold Mines Limited continues to test gold zones on its Timmins gold project inside the city limits of Timmins. The company announced a $2 million exploration budget for 1997 to continue the drill program after obtaining promising results at the end of 1996.

Patricia Mines Inc. completed in-fill definition drilling of 7500 m on the Goudreau Lake Deformation zone at its Island gold project, 45 miles north of Wawa. In 1997, the company plans to conduct an extensive surface exploration program on its extensive land holdings in the Island gold project area and to continue diamond drilling on the Deformation zone.

Mineral Exploration Incentives Programs

The Ontario Prospectors Assistance Program (OPAP) provides financial assistance to qualified individuals

and companies involved in mineral exploration in Ontario. The grants provide 100% of approved eligible expenses to a maximum of $10 000 per individual per year. The OPAP budget allocated for 1997 is $2 million. About 205 of 357 applicants will be approved for OPAP assistance in 1997. In 1996, 215 of 357 applicants were approved for assistance.

5.7 MANITOBA

Overview

Mineral exploration expenditures during 1996 are estimated at $40 million compared to $33 million in 1995. Surface diamond drilling in 1996 is estimated at 152 894 m compared to 150 371 m in 1995. The total area of claims and exploration permits recorded in Manitoba during 1996 was 295 316 ha. The total area of mineral dispositions in good standing at the end of 1996 was 1 756 121 ha.

New Mines and Development

In July 1996, Black Hawk Mining began full production from the Farley Lake open-pit gold mine east of Lynn Lake. This coincided with the depletion of reserves at the BT open-pit. Higher gold grades from Farley are expected to increase annual production to 1.8 million grams in 1997.

Inco Limited continued extensive underground development of the 1-D nickel deposit near Thompson. Production from 1-D rose to 6 million kg of nickel in 1996 and it will nearly double to 11.4 million kg in 1997.

Inco also proceeded with the deepening of the Birchtree mine shaft from the 1015-m level to the 1235-m level. Lateral development was initiated on two levels of the shaft extension.

Rea Gold Corporation's underground project at the Bissett gold mine in southeastern Manitoba will be mostly completed by the end of June 1997. The first ore is scheduled to be hoisted to surface in July. The company hopes to reach full production of 900 t/d by the end of the year.

Exploration Projects

Hudson Bay Exploration and Development Company Limited continued to fly the SPECTREM airborne geophysical system on parts of the Flin Flon and Lynn Lake greenstone belts and the southwestern extension of the Thompson Nickel Belt. The company also conducted extensive ground geophysics and diamond drilling to test the numerous targets generated by the survey.

Consolidated Callinan Flin Flon Mines Limited conducted deep drilling on the War Baby claim on what is believed to be the down-plunge extension of the Callinan mine.

Aur Resources completed an airborne geophysical survey over a large part of the Lynn Lake belt. Ground geophysics and diamond drilling were carried out on properties near the former Fox mine, Eldon Lake, Frances Lake and Barbara Lake.

Falconbridge Limited conducted extensive drilling at William Lake on the southwestern extension of the Thompson Nickel Belt. Very promising nickel mineralization was intersected in several holes. Favourable Precambrian rocks on this property are covered by over 100 m of younger Paleozoic carbonate rocks.

During 1996, Inco Limited continued to drill at the Pipe project south of Thompson. When the discovery was announced in 1994, the Pipe 1 Deep structure was reported to contain 3.63 Mt grading 2.32% nickel with copper, cobalt and platinum group element values.

TVX Gold Inc. and partner High River Gold Mines Ltd. successfully explored their property near Snow Lake. New gold mineralization was discovered in the Birch area north of the New Britannia mine.

Gossan Resources Limited and partner Cross Lake Mineral Exploration Inc. carried out metallurgical studies on the Pipestone Lake deposit where a resource of 495 Mt of 4.42% titanium dioxide has been drill indicated.

Prospectors Assistance Program

The Government of Manitoba will reimburse 50% of the prospecting expenditures of qualifying self-employed prospectors to a maximum annual grant of $7500 on pre-approved projects. In fiscal year 1996/97, 39 applications for grants were received, of which 32 were approved. Twenty-two projects were completed, resulting in the payment of $83 350 in provincial funding.

Mineral Exploration Assistance Program

The Mineral Exploration Assistance Program was established in the fall of 1995 to stimulate new investments in the mineral exploration industry in the province. It provides funding for eligible grassroots exploration. Companies can obtain 25% of eligible exploration expenses up to a maximum of $300 000 per year per recipient or, for eligible expenses on programs conducted in the Northern Superior Geological Province target area, 35% to a maximum of $400 000 per year per recipient.

Funding of $10 million has been approved for the program. One million dollars was offered in October 1995 and $3 million was offered in each of the next three fiscal years.

As of April 30, 1997, $6.4 million in financial assistance had been allocated to 103 projects.

Land Use

The governmental land use evaluation process has been modified to be more responsive to the concept of sustainable development and to maintain access to lands containing high mineral potential and security of tenure for mining purposes. A new geographic information system for land use has been established to provide the mining industry with accurate up-to-date land use information and to help industry better plan exploration programs and to identify possible land access encumbrances.

In 1996, all provincial parklands were evaluated for mineral potential and candidate sites for the Endangered Spaces Campaign were identified. A similar process will be carried out in 1997 for Wildlife Management Areas.

5.8 SASKATCHEWAN

Overview

The annual survey of mineral exploration expenditures carried out by the resident geologists estimates expenditures at $44 million in 1997, compared to $35 million in 1996 (**Table 11**). These figures exclude uranium test mining and underground exploration costs. Exploration levels for uranium in 1996 continued to grow and this upswing, which began in 1993, is expected to continue through 1997.

The total number of dispositions in good standing at the end of 1996 was 3422 (covering 2.8 million ha) compared to 5421 (covering 4.2 million ha) at the end of 1995. In 1996, 783 new dispositions were recorded covering 886 794 ha, an increase of 80% in the number of new dispositions over the previous year. The decline in hectarage of claims in good standing was primarily due to the dropping of land acquired for diamond exploration.

Uranium

In 1996, the increase in uranium exploration activity corresponded to a rise in the metal's spot price in the early part of the year. This trend of increased exploration activity is continuing in 1997 despite a softening of spot market prices. Ten companies continued to explore in joint ventures for uranium in the Athabasca Basin. Although discovery potential remains high, no significant new finds were reported last year.

Cogema continued the development of the $250 million McClean Lake project, which is expected to be in production by late 1997. On completion of mining of the JEB deposit in early 1997, the open-pit is to be converted into a tailings facility. The McArthur River project, which was under review by the Joint Federal-Provincial Panel on Uranium Mining Development in northern Saskatchewan, has been

recommended and very recently received environmental approval from both orders of government. The construction of this $360 million project is expected to begin in 1997, with commercial production starting in 1999. Underground exploration has identified 416 million lb of U 3 O 8 with an average grade of 12.7% uranium (15% U 3 O 8 for 160 000 t of uranium). The panel has yet to complete the reviews of the $240 million Cigar Lake project and the Midwest project.

Following the depletion of ore reserves stockpiled from the Deilmann open-pit, McArthur River will provide feed for the Key Lake mill, which produces about 14 million lb of U 3 O 8 per year. The Cigar Lake project could follow a similar schedule, with ore processed through McClean Lake's expanded mill. At Midwest, mining will be integrated with the development of the McClean Lake orebodies. These projects ensure that production at the Key Lake and McClean Lake mills will last until 2020 and 2038, respectively.

In 1996, Cogema increased annual production at Cluff Lake to 5 million lb U 3 O 8 (near full capacity) from 3.9 million lb U 3 O 8 in 1995. The Dominique-Janine underground and extension open-pit mines are providing ore for this expansion. Significant reserves were established at West Dominique-Janine in 1996. At Rabbit Lake, which continued to operate at less than capacity, production in 1996 increased to about 10 million lb U 3 O 8 . Ore originates at the Eagle Point mine and the A and D zones of the Collins Bay open-pit operation. The D zone pit was mined in 1996 and decommissioned, and the A zone was mined over the winter of 1996/97. Stockpiled ore from the pits and Eagle Point production will provide mill feed early into the next century.

Gold

Following a downward revision of reserves at Cameco Corporation's Contct Lake mine, surface and underground programs attempted to define new reserves and to redefine those that already exist. Production was 60 562 troy oz, up from 47 434 troy oz in 1995.

Claude Resources Inc. continued operations at the Seabee mine, although output declined slightly due to a decrease in ore grade and a six-week slow-down due to a transformer substation fire. The decrease was only partly offset by increasing throughput. Production was 36 700 troy oz. New reserve figures of 962 675 t averaging 9.86 g/t gold were just released. These reserves are in excess of the original reserves of 952 000 t and the mine has processed in excess of 1 000 000 t grading 8.96 g/t gold. Construction of a new shaft and hoist and the mining of higher-grade ore reserves are expected to increase output in 1997.

On October 7, 1996, Waddy Lake Resources Inc., a wholly owned subsidiary of Golden Rule Resources Ltd., poured the first gold from the Komis mine. Underground production of some 400 t/d was trucked to the refurbished Jolu mill, 60 km to the south. Although annual output there was forecast at 44 000 troy oz, a recent announcement stated that the production grade is below expectations and mining has been suspended.

Fewer than 15 companies are conducting gold exploration. Cameco, Uranerz Exploration & Mining Ltd., Petro Plus Inc., Golden Band Resources Inc., and a Consolidated Pine Channel Gold Corp. and JNR Resources Ltd. joint venture are exploring for gold in the La Ronge gold belt. Elsewhere in the province, Claude Resources Inc., under an option agreement with Cameco and Husky Oil Ltd., resumed exploration at the Amisk-Laurel Lake property in the Flin Flon area. At Laurel Lake, Claude has revised reserves to 1.4 Mt grading 13.4 g/t gold. Greater Lenora Resources Corporation was not active on its Goldfields Project near Uranium City.

Base Metals

No base metals have been produced in Saskatchewan since Hudson Bay Mining & Smelting Co. Ltd. ceased operations at its Flin Flon mine in 1992. Mining of the Callinan deposit's North zone will, however, extend into Saskatchewan in 1997. The company has announced the potential development of an underground copper mine at Konuto Lake, a project which already has received development approval from the government. Phase 1 will involve driving a ramp down to the 140-m level, where further delineation drilling will be done. Depending on the results of the underground drilling program, a decision will then be made as to whether or not the project will proceed.

Base-metal exploration involved fewer than 10 companies in Shield and in sub-Phanerozoic programs west and southwest of Flin Flon. At the Mokoman Lake deposit, optioned from Copperquest Inc., Leader Mining International Inc. reported increased open-pit reserves of 11 Mt grading 1.07% copper with

significant gold, silver and cobalt values. This resource has been upgraded to 79 Mt grading 1% copper (equivalent) by the 1996/97 winter drilling program.

A joint venture between Uranerz Exploration & Mining Ltd. and Kensington Resources Ltd. continued grassroots nickel-copper exploration, including airborne geophysical and drill programs, on the Clearwater anorthosite complex in the Western Craton.

Gitennes Exploration Inc. tested the Howard Lake nickel prospect in La Ronge, Noranda Exploration & Development Ltd. renewed its work on the Janice Lake copper prospect in the Wollaston Domain, and Far West Mining Ltd. was active in the George-Spence lakes area evaluating SEDEX-style lead-zinc mineralization.

Diamonds

In 1996, the amount of land under disposition for diamond exploration declined to 1 million ha, down from 4 million ha at the height of the diamond boom in 1994. However, diamond exploration expenditures in 1996 rose 50% to $6 million.

On Kennecott Canada Inc.'s Candle Lake properties, which were optioned from War Eagle Mining Company and Great Western Gold Corporation, 11 definition holes were drilled on kimberlite no. 28, a banana-shaped body up to 140 m thick. Samples were sent for caustic fusion testing. The company plans to take a 45-t bulk sample from kimberlite no. 29/30, a 70-Mt body drilled in 1995 from which 46 micro- and macro-diamonds per 100 kg were recovered.

The Fort à la Corne project is a joint venture divided among Kensington Resources Ltd., Uranerz Exploration & Mining Ltd. (the operator), Cameco Corporation, and Monopros Ltd. (a wholly owned subsidiary of De Beers Consolidated Mines). Drilling there in 1996 consisted of 30 small-diameter holes. Of these, 22 were drilled on untested kimberlite targets; the remainder further evaluated known kimberlites. Macro-diamonds have been recovered from 34 of the 67 diamondiferous bodies tested since 1989. Ongoing exploration with large-diameter holes will evaluate kimberlites in excess of 100 Mt that have shown the best grades to date.

In addition, five other individual companies or joint ventures drilled kimberlite targets in 1996. Of these, the Shore Gold Inc. and Saskatchewan Mining Syndicate joint ventures both hit kimberlite. With 50% of the samples taken from five NQ-sized holes already processed, Shore announced the recovery of 72 diamonds. These diamonds occur in a distinctive kimberlite flow averaging 35 m in thickness.

Mining Lands Initiatives

Consultations with industry on revisions to The Mineral Disposition Regulations, 1986 are on-going. A preliminary round of amendments, predominantly housekeeping in nature, were passed on July 23, 1997. Included in this package is a clear definition of the boundary between the northern and southern mining districts, and all staking in the southern mining district will be map staking. Discussion is ongoing on a number of other issues including the length of time that dispositions can be held, the collection of data in a digital format, and fee structures.

The disposition boundaries for all active dispositions have been digitized and consultations are still ongoing with Saskatchewan's Central Surveys and Mapping group to get the appropriate digital base for these claim maps. Pilot work is being done by putting some of this information on the Department of Energy and Mines' Web site as well. The monthly "Notice of Re-opening" is now posted on the Internet and work is in progress to have the search book of active dispositions posted on the Web site.

The Department will be reviewing all Crown Reserves that were taken out for potential treaty land entitlement selections and re-opening any that are no longer required.

5.9 ALBERTA

Overview

Alberta experienced a resurgence of staking activity in early 1997 in reaction to the announcements of

diamond exploration results in northern Alberta. From the beginning of January to mid-May of 1997, some 3475 applications for metallic and industrial mineral permits had been filed, covering an area of approximately 31 000 000 ha. This amount of activity is very comparable with the earlier diamond staking rush that occurred in the winter of 1992/93.

Ashton Mining of Canada Inc. announced in January that it had discovered and drilled kimberlite pipes on the Buffalo Head Hills property in northern Alberta, held by Ashton and its partners Pure Gold Resources Inc. and Alberta Energy Company. In early March, Ashton announced that it had concluded its winter program with the drilling of 10 core holes and the discovery of a total of 11 kimberlite pipes. Subsequent analysis of these cores showed that some of the pipes are diamondiferous, including two with a significant number of macro-diamonds. Ashton plans further work this summer on a number of similar geophysical anomalies to those already proven to be pipes.

Kennecott Canada Inc. drilled a number of holes in the Hinton area of western Alberta on property optioned from New Claymore Resources Ltd. and Montello Resources. Alluvial diamonds had been discovered on this property in 1995, a discovery that was followed up by geochemical and geophysical work. Kennecott drilled a number of the best geophysical anomalies during the winter of 1996/97, but reported no promising results. Further work is planned for the 1997 summer field season.

In early 1997, Marum Resources Inc. reported the recovery of two micro-diamonds from its Peace River property. Marum was conducting an outcrop sampling program related to its oolitic iron deposit on the property and decided to analyze some interesting grains, only to discover that they were diamonds. Marum continues to work on attracting overseas interest in the development of the one-billion-ton 35% iron deposit.

Tintina Mines Ltd. and Birch Mountain Resources Ltd. joined forces in 1996 to evaluate poly-metallic anomalies in the carbonates of northeastern Alberta. Their activities expanded to include overlying Cretaceous sandstones and shales near Fort McKay and the Birch Mountains and basement rocks in the north. Tintina Mines Ltd. and NSR Resources commenced drilling in January 1997 to evaluate huge areas of anomalous, coincident enrichments of copper, nickel and zinc in Cretaceous shales.

Alberta seems poised to attract increased exploration in the next few years with record amounts of land under permit and the announcement of positive exploration results. For the last two calendar years, assessment work reported has been in excess of $7 million per year, and it is anticipated that this amount will increase significantly.

Sayers Securities Limited reported that the oil and gas industry raised $277.2 million through flow-through shares in 1996. This was an 81% increase over the 1995 figure of $153.2 million. The high level of flow-through share activity since 1992 is attributable to changes to the Income Tax Act in December of 1992. It also indicates that the revisions to the flow-through tax regulations introduced on March 6, 1996, did not have as large a negative impact as first projected.

5.10 BRITISH COLUMBIA

1996 Statistical Overview

Exploration expenditures in British Columbia (B.C.) for 1996 are estimated at $116.5 million, up 46% from the $79.4 million spent in the province in 1995 (federal-provincial survey of mining and exploration companies). Much of this significant increase is attributed to increased spending at active mines in search of new resources, the advancement of many projects that are either in the Environmental Assessment Process or are close to entering it, and the Government's release of geochemical and geophysical survey data in the Cry Lake and East Kootenay areas respectively.

New mineral claims and leases increased by 17% from 8500 km 2 in 1995 to 10 000 km 2 in 1996. Free miner certificates issued for companies were up by 30% from 421 in 1995 to 547 in 1996, and were down by 7% for individuals from 5566 to 5166 in the same two years.

In 1996, 200 companies (representing approximately 210 projects) reported exploration expenditures in B.C. Sixty-three of these spent more than $500 000 and 32 of these spent more than $1 million. The average expenditure per company is estimated at $580 000.

According to the Ministry of Employment and Investment's Geological Survey Branch estimates, 15% of exploration expenditures were at mine sites, 73% were on advanced projects including bulk sampling, environmental studies and reclamation programs, and 12% were on less advanced and grassroots exploration programs (**Figure 21**).

As in previous years, approximately 45% of total expenditures were spent in the northwestern part of the province. The very low level of expenditures on grassroots or generative work is of concern. All regional Ministry offices recorded increases in exploration spending in their respective areas in 1996: Smithers (+29%), Prince George (+14%), Kamloops (+44%), Cranbrook (+12%), and Vancouver (+25%).

Approximately 90% of total exploration expenditures were targeted at precious and base metals, 8% at coal and 2% at industrial minerals.

Also noteworthy was the interest shown by a few integrated aggregates producers, which were looking at potential entry strategies into the construction aggregates sector of B.C.'s growing economy.

1997 Outlook

Successful exploration from previous years has led to three large open-pit, porphyry-type deposits (Kemess South, Huckleberry and Mount Polley) reaching the construction phase, with estimated capital costs totalling $650 million. Mount Polley is scheduled to be in production in July 1997, Huckleberry in September 1997, and Kemess South in the second quarter of 1998. Collectively these new operations will create approximately 700 new full-time jobs and an estimated 1500 indirect jobs.

The historic Bralorne gold mine is scheduled to re-open in 1997. The Golden Bear mine is poised to go back into production in the summer of 1997 as a bulk-mineable, heap leaching gold operation. After a hiatus in exploration in 1995, the Red Mountain gold project had the largest exploration expenditure of approximately $8 million in 1996. Unfortunately, there will be no expenditures on this project in 1997.

Projected exploration expenditures show a modest 8% increase from $116.5 million in 1996 to $126.2 million in 1997. However, actual expenditures are subject to many decision variables tied to ongoing results and business, economic and political factors and, therefore, they may vary considerably from this forecast. The actual range of expenditures is estimated at $75 million to $130 million (i.e., $126 million, plus 5%, minus 40%). While exploration ratios show high leverage on the side of project developments and advanced-stage exploration compared with grassroots and generative projects, there is an expectation that continued successes in the former will stimulate more generative work in the future.

Successful exploration and development projects at several mines have increased reserves (**Figure 22**) and mine life (e.g., Myra Falls, Highland Valley Copper, Snip, Eskay Creek, Table Mountain, QR, Gibraltar, Premier and Similco). In particular, gold-silver production increased significantly at the Eskay Creek mine and identified resources have increased by over 18%. Exploration success has encouraged Prime Resources to build a mill which, subject to approval by June, will be constructed and operating by the end of 1997. The potential for smaller projects (e.g., Brett, Pellaire, Lexington, Skinner), utilizing custom milling facilities, will be important in the future. Significant exploration expenditures on the Telkwa, Willow Creek and Tsable River coal projects have advanced these projects close to the decision point where they could well enter the development phase.

Releases of Regional Geochemical Surveys (RGS) data for the Cry Lake (104I) area and of air-borne geophysical data for the East Kootenay region have stimulated staking activity. The release of RGS data for the Toodoggone River (94E) and McConnell Lakes (94D) map sheets and additional airborne geophysical data for the East Kootenay region should help sustain the exploration momentum in this area.

The many copper and gold-bearing porphyry deposits discovered during the 1960s and 1970s (e.g., Red Chris and Lorraine) will continue to be explored and developed. Renewed interest in these deposits is indicated by the large program conducted on the Mac molybdenum-copper project in 1996. SEDEX (e.g., Akie) and volcanogenic polymetallic sulphide (e.g., Tulsequah Chief/Big Bull and the recent Wolverine discovery in Yukon-Tanana Terrane rocks) deposits offer small to medium tonnage and high-grade potential, particularly those enriched in precious metals. The stratiform, gold-enriched (seafloor hydrothermal) Eskay Creek-type deposits are examples of low-tonnage, but potentially extremely profitable, high-grade targets. The transitional setting, which includes vein and skarn deposits related to

porphyry systems (e.g., Red Mountain, Willoughby, Snip, Midway), offers similar small to medium tonnage and high-grade potential.

The potential for bulk-mineable (heap-leachable) gold deposits will continue to be examined. Future developments at the Golden Bear mine will focus on the "no seeum" (Carlin-type) gold mineralization hosted in the carbonate complex. In the Cassiar camp, the Taurus property will continue to be explored for its bulk-mineable potential.

In general, the long-term outlook for mineral markets is very good throughout the Pacific Rim; British Columbia is well positioned to compete.

Development Stage Projects

The Mount Polley gold-copper project (**Figure 23**) is nearing completion with production scheduled for July 1997. The project is owned by Imperial Metals Corporation (55%) and by Sumitomo Corporation of Japan (45%). The mine will be developed by the Mount Polley Operating Company, and Sumitomo Corporation will act as concentrate marketing agent. Annual production is projected at 3110 kg (100 000 oz) of gold and 11 800 t (26 million lb) of copper over its 12- to 15-year mine life. The operation will create 170 new full-time jobs and cost $123.5 million.

Huckleberry Mines Ltd. began construction on the Huckleberry porphyry copper-molybdenum project. It is owned by Princeton Mining (60%) and a consortium of Mitsubishi Materials Corporation, Dowa Mining Co. Ltd., Furakawa Co. Ltd. and Marubeni Corporation. The project is scheduled for completion in late 1997 at a capital cost of $137 million. A total of 29 500 t (65 million lb) of copper and 54 t (1 million lb) of molybdenum will be produced annually over the 16-year mine life. In addition, the mine will produce 185 kg (6000 oz) of gold and 8400 kg (270 000 oz) of silver annually. Construction will require 300 people and the operating mine will create 180 to 200 permanent full-time jobs.

Royal Oak Mines Inc. began construction at the Kemess South project, which is owned and operated by its wholly owned subsidiary, Kemess Mines Inc. Capital costs are estimated at $390 million and the mine is scheduled to open in the second quarter of 1998. The operation is forecast to produce 7775 kg (250 000 oz) of gold and 27 240 t (60 million lb) of copper annually over its minimum 16-year life. The mine will employ approximately 550 workers during peak construction and create up to 350 new permanent jobs when the operation is running at full production. Bralorne-Pioneer Gold Mines Ltd , in a joint venture with International Avino Mines Ltd., purchased a 150-t/d milling plant from Zeballos and re-installed it at the Bralorne site. Initial production, scheduled for 1997, will start above the "800 level." The initial capital cost is estimated at between $5 million and $7 million. Mining will begin from surface on the Peter vein.

Advanced Exploration - Metals

A detailed prefeasibility study was completed in 1995 on Taseko Mines Ltd.'s Prosperity (formerly Fish Lake) porphyry gold-copper deposit. During 1996 and the spring of 1997, a $13.5 million in-fill drilling program is being completed to upgrade previously drilled holes. The company forecasts annual production of 11 350 kg (365 000 oz) of gold and 69 460 t (153 million lb) of copper. The mine is projected to have a 21-year life, and capital costs are estimated at US$430 million. A bankable feasibility study will be developed after the current drilling program is completed.

Placer Dome Inc. is currently reviewing options to lower estimated capital costs for its Mt. Milligan porphyry gold-copper deposit and is developing a revised prefeasibility study that is scheduled for completion in 1997.

After American Bullion Minerals Ltd. (80% interest) presented a prefeasibility study on its Red Chris copper-gold project in the spring of 1996 to its partner Teck Corporation (20% interest), Teck elected not to complete a final feasibility study. During the 1996 field season, however, American Bullion continued with ongoing environmental and socio-economic studies related to its application for mine development certification. In May 1997, Hunterbrooke Capital gained control of the project.

International Skyline Gold Corporation increased its resource tonnage in 1996 as the result of a drilling program on its Bronson Slope polymetallic (gold-copper-silver-molybdenum) porphyry property, located adjacent to the Snip mine. Metallurgical tests have demonstrated that molybdenum and magnetite are

recoverable, which also adds to resource estimates. Feasibility stage studies are scheduled for completion in 1997.

With a project budget of $8 million, Royal Oak Mines Inc. drilled a number of targets in its Red Mountain gold-silver project, 10 km east of Stewart. A 300-m underground extension was also completed. No further exploration was planned for 1997.

Teck Corporation drill-tested a number of targets in the Iron Mask region, principally in the area between the Afton and Ajax deposits. Teck (70%) also continued to drill-test the Rainbow No. 2 porphyry copper-gold-molybdenum target under a joint-venture agreement with owner Getchell Resources Inc. (30%). A follow-up phase of exploration was completed in early 1997. Results are being evaluated.

In the Greenwood camp, Britannia Gold Corporation and Bren-Mar Resources Ltd. completed a production-size, 600-metre-long decline, and an underground diamond drilling program to define a high-grade resource in the Lexington Main zone. The decline is being extended for further drilling and draft permits have been received to allow mining at 25 000 tonnes per year (t/y) and processing of the ore at a nearby custom milling facility.

Imperial Metals Corporation completed an airborne geophysical survey over the Giant Copper property, followed by diamond drilling to test the "porphyry to transitional type" deposit.

Camnor Resources Ltd., under a joint-venture agreement with Gold Giant Minerals Inc., completed surface and underground drilling on several zones in the Willoughby project. The underground adit on the North zone was advanced as part of an overall $1.3 million program.

Redfern Resources Ltd. continued to conduct on-site environmental and socio-economic studies, associated with its application for a project approval certificate for its Tulsequah Chief volcanogenic massive sulphide deposit. Contingent on project financing and government approval, the company could start detailed engineering design and construction on the project in 1997.

In the Gataga district, southeast of the Cirque zinc-lead-silver deposit, Inmet Mining Corporation continued to explore the depth potential of the Akie zinc-lead-silver SEDEX deposit that it holds under an option agreement with Ecstall Mining Corporation.

At the Golden Bear mine site, Wheaton River Minerals Limited and North American Metals Corporation carried out detailed surface diamond drilling. The $1.7 million 1996 exploration program was aimed at defining additional reserves to add to a long-term heap-leach mining program. An expanded feasibility study was completed in late 1996 that focused on mining and milling material from the Kodiak A and Ursa zones. In addition, testing anomalies in the West project resulted in the discovery of three new gold zones, all within the carbonate complex. Beginning in July, ore will be loaded on a previously constructed leach pad with the first gold production expected in September.

At the Taurus gold project in the Cassiar camp, Cyprus Canada Inc., under a joint-venture agreement with International Taurus Resources Inc. and Cusac Gold Mines Ltd., continued its exploration program to delineate a large tonnage, low-grade, bulk-mineable, potentially heap-leachable deposit in the spring of 1996. This program included surface drilling on several induced polarization targets and an extensive trenching and surface mapping program. Taurus re-acquired its full interest in the property when Cyprus relinquished its agreement and negotiated an agreement with Cusac to earn a 70% interest in its claims. Subsequently, an in-fill reverse circulation drilling program and additional trenching have extended reserves.

At the Specogna (formerly Cinola) gold deposit, which is part of Misty Mountain Gold Ltd.'s Harmony gold project on Graham Island in the Queen Charlotte Islands, a multi-million-dollar diamond drilling program was conducted in 1996 and will be completed in the first quarter of 1997. Feasibility stage mining plans will examine both the bulk-mineable low-grade and the high-grade bonanza (underground) potential for this deposit. Metallurgical and environmental studies are under way.

In late 1996, Golden Angus Mines Ltd., a wholly owned subsidiary of Canarc Resources Corporation, began a multi-million-dollar underground exploration and development program on its Polaris-Taku project in the Tulsequah area. Planned drilling is targeted to identify sufficient mineable resources to complete a bankable feasibility study for production in the spring of 1998. Engineering, environmental

and metallurgical studies, as well as the permitting process, are under way.

In 1995, Fairfield Minerals Ltd. sold 118.4 kg (3807 oz) of gold and 185 kg (3950 oz) of silver from its bulk sampling program on the Siwash North vein of its Elk property. They were shipped to Asarco's smelter at Helena, Montana. Follow-up drilling programs have been completed to test several other zones.

In the spring of 1996, Huntington Resources Ltd. completed a bypass tunnel to enter the 1205-m level on the Bonanza zone of the Brett epithermal gold deposit. Mined and stockpiled material was trucked to Cominco's Trail smelter in early July 1996. Mining and stockpiling continue with further shipments planned.

At the Blackdome gold mine, Claimstaker Resources Ltd. and joint-venture partner Petro Plus Ltd. conducted a program of trenching, drilling and underground drifting and raising in search of new reserves on veins identified by previous work.

Athabaska Gold Resources Ltd. continued underground drilling and development in the Idaho zone and surface drilling in the McMaster zone of its past producer Ladner Creek (Carolin) gold mine, 18 km northeast of Hope. These turbidite-hosted, mesothermal, epigenetic deposits were mined by underground techniques between 1982 and 1984. In addition, a trenching program was oriented towards defining an open-pit resource. Bulk-sample metallurgical testing was completed and it was confirmed that gold recoveries will reach the 85% range.

Advanced Exploration - Industrial Minerals

Mountain Minerals Company Ltd. is developing a market for zeolite, in a variety of agricultural applications within Alberta, for its product from the Ranchlands Z-1 and Z-2 pits near Cache Creek.

In 1995, Canmark International Resources Inc. mined a 10 000-t bulk sample from the Sunday Creek zeolite deposit near Princeton to promote market development in the Lower Mainland. Market tests are continuing.

Quinto Mining Corporation Ltd. and IMP Industrial Mineral Park Mining Corporation continued sampling and evaluating graphite/sericite and graphite potential from their Lumby and Black Crystal (near Slocan) properties respectively. IMP estimates a resource of flake graphite in excess of 27 Mt in the Black Crystal deposit. The company stockpiled graphite at the mill, which is nearing completion. It processed 5.5 t at Quinto's laboratory in Lumby.

Super Twins Resources Ltd. continued exploration of the Isk wollastonite deposit on Zippa Mountain in the Iskut River area. The company hopes to establish a proven reserve of 18 Mt. A mine feasibility study is under way for production targeted to begin in 1997.

After the discovery of gem-quality sapphires in the Slocan Valley (Blu Starr property), Anglo Swiss Industries Ltd. continued sampling and evaluating the economic potential of numerous prospects. It also conducted systematic prospecting of alkaline rock occurrences in core gneiss units of the Omineca Crystalline Belt. Other minerals discovered include tourmaline, beryl, topaz, ruby, amethyst, and Japan quartz crystals. Gem-quality aquamarine has been found in pegmatitic dikes in the Valhalla Gneiss Complex near Airey Creek, west of Slocan Valley. High-quality black and smoky grey quartz crystals are also common.

The Klinker fire opal locality near Vernon, being operated by Okanagan Opal Inc., has sparked some interest and at least two sites were discovered in 1996. Small-scale test mining and marketing is ongoing.

Mining companies, as well as individual prospectors, are evaluating new dimension stone properties. Rose-pink granite and brown syenite were sampled for testing near Grand Forks, and a flagstone property was discovered near Nipple Mountain, east of Kelowna.

A sodalite occurrence at Mt. Laussedat, north of Golden, produced several thousand pounds of low-grade sodalite rock in 1996.

A pilot plant to process Cassiar asbestos tailings for the recovery of short fibres has been assembled by

B.C. Chrysotile Corporation and processing may commence in 1997.

Quest International Resources Corp. reported the discovery of two new kimberlite pipes and a 1.5-mm gem-quality diamond fragment on its Ice property near Elkford in southeastern British Columbia. Five kimberlite pipes were previously identified. A bulk sample was taken and shipped to Fort Collins, Colorado, for diamond testing.

Ava Resources Ltd. rehabilitated the access road to its attractive pink, banded quartzite deposit (Wishaw), east of Prince George, in preparation for test quarrying and sampling.

Cassiar Coal Company Ltd. continued development work on its Stitt Creek placer garnet property north of Revelstoke.

Highland Talc Ltd. is also active in developing the Talc Group claims north of Boston Bar.

Advanced Exploration - Coal

At the Telkwa thermal coal project, Manalta Coal Limited conducted an extensive exploration program. In addition to drilling, a bulk sample was excavated in the Tenas Creek area to provide coal quality and acid rock data for the Number 1 seam. The Telkwa deposits are being computer modelled as an initial step in preparing a mine feasibility study. Manalta has entered the Environmental Assessment Process for a project approval certificate.

At the Tsable River project, south of Courtenay on Vancouver Island, Quinsam Coal Corporation (63%) and Marubeni Corporation (37%) conducted a large exploration drilling program. The companies are currently assessing the coal quality and environmental and mine planning studies are in progress.

In the northeast, at the Willow Creek project, a joint venture between Globaltex Industries Inc., Mitsui Matsushima Canada and BCR Ventures conducted an advanced-stage drilling program. A full feasibility study is scheduled to be completed by late 1996 or early 1997.

North of the Line Creek mine on Mount Michael Ridge, Line Creek Resources Ltd. conducted a helicopter-supported drilling program.

In the southeast, a small exploration program, including a proposed bulk sample test of 2000 t to 5000 t, was conducted on the Iron Creek (formerly Bingay Creek) prospect.

Exploration - Porphyry and Porphyry-Related Deposits

The Babine camp was very active in 1996. Booker Gold Explorations Ltd. continued drilling high-chargeability and low-resistivity induced polarization anomalies on its Hearne Hill porphyry copper-gold breccia property (**Figure 24**), 20 km north of the Bell mine. Drilling re-commenced in early 1997 and is expected to continue throughout the year.

At the Nak porphyry copper-gold-molybdenum prospect, 30 km northeast of the Bell mine, Hera Resources Inc. drilled parts of a large alteration system.

Hera also completed a program of geological mapping and geochemical and geophysical surveys on its Trail Peak copper-gold prospect, 55 km northwest of its Nak property. A comprehensive drilling program is planned for early 1997.

Spokane Resources Ltd. entered into an agreement to acquire Rio Algom Exploration's rights, title and interest in the Mac molybdenum-copper property 40 km southeast of the Granisle and Bell mines. The Mac deposit represents a unique metal association (i.e., between an Endako molybdenum-type and a Bell copper-type). Following an early 1997 drilling program, the company is estimating reserves and evaluating the results.

At the Lorraine copper-gold-silver project, Lysander Gold Corporation expanded its claim holdings. It believes it has identified a major buried alkalic centre lying immediately to the east of the Lorraine

property.

In the northern part of the Highland Valley southwest of Kamloops, Getty Copper Corporation conducted drilling programs on the Getty North (Krain) and nearby targets; the entire property encompasses approximately 100 km 2 . Getty is conducting a property-wide program in 1997.

Verdstone Gold Corporation and Molycor Gold Corporation diamond drilled two deep holes on their Climax-Henderson-type Salal Creek (Float-Creek zone) molybdenum prospect 70 km northwest of Pemberton. Extensive surface sampling and mapping were completed.

During 1996, Big Valley Resources Inc. conducted diamond drilling on the Lloyd 2 deposit on its Lloyd-Nordik copper-gold property, 1.5 km north of the Mount Polley open-pit development. During 1996, Verdstone Gold Corporation and Molycor Gold Corporation drilled their Crow-Rea porphyry molybdenum prospect located 24 km south of the Brenda mine.

Exploration - Precious-Metal-Bearing Veins and Bulk-Mineable Deposits

In the northern Toodoggone district, AGC Americas Gold Corporation completed a drilling program on the Finn zone on its JD polymetallic gold-silver property, 65 km north of the Kemess South project. Epithermal-style mineralization is in a brecciated and silicified gold zone, enveloped by a large stockwork zone of quartz-carbonate veining with polymetallic dissemi-nated and massive sulphides. Further drilling, geophysics and metallurgical testing are planned for 1997. Calculation of a mineral inventory is under way.

In the Blackwater River area in the Interior Plateau region of central British Columbia, Teck Corporation completed extensive drilling on its Tsacha epithermal gold-silver vein target. A Tommy vein resource was calculated.

To the east, Phelps Dodge Corporation of Canada Ltd. drill-tested its Tam/Taken gold property, which adjoins the Tsacha property to the west.

Nearby to the northwest, Lucero Resource Corporation completed a diamond drilling program on its Wolf epithermal gold prospect.

In the Likely area, Cyprus Canada Inc., under an option agreement with Consolidated Logan Mines Ltd. and Eastfield Resources Ltd., completed trenching, sampling and mapping on the Spanish Mountain bulk-mineable gold target. Cyprus terminated its option in the fall as the property does not fall within its corporate criteria.

In the Wells-Barkerville area, International Wayside Gold Mines Ltd. conducted a large surface and underground diamond and percussion drilling program on its Cariboo Gold Quartz mine. The main objective is to outline a zone of gold vein mineralization. Currently, the company is examining a proposal for a 1000-t/d milling operation from an open-pit, including the potential of using a vat (heap) leach system to suit a combination of underground and open-pit ore.

South of Red Mountain, in the Stewart camp, Teuton Resources Corporation and Minvita Enterprises Ltd. conducted a multi-million-dollar surface diamond drilling and trenching program on its new Clone high-grade gold-cobalt discovery. Funding was provided by Homestake Canada Inc. and Prime Resources Group; they retain a first right of refusal on the property. An airborne geophysical survey earlier in the season provided additional targets for drill testing.

In the Lillooet area, Homestake Canada Inc. drilled the Ample/Goldmax mesothermal gold vein target located to the east of the historic Bralorne gold camp.

North of Lillooet, Stirrup Creek Gold Ltd. conducted further trenching and diamond drilling on Zone V of its Watson Bar (Second) gold target (possibly a Carlin-type deposit).

Immediately along strike to the northwest, First Point Capital Corp. conducted geochemical and geological surveys on the Mad epithermal prospect.

West of Port Hardy, First Choice Industries Ltd. conducted preliminary drilling on its high-sulphidation, gold-enriched Knob Hill prospect, as well as a follow-up geophysical survey.

Exploration - Precious Polymetallic Massive Sulphide Deposits

On the Dragon polymetallic "Myra Falls-type" prospect, located near Gold River on Vancouver Island, which Westmin Resources Ltd. holds under an option agreement with Doromin Resources Ltd., Westmin conducted a two-phase program that included geological mapping, geochemical and geophysical surveys, and diamond drilling.

At the Hail-Harper Creek volcanic-hosted stratabound copper prospect near Clearwater, American Comstock Exploration Ltd., under agreements with MBI Mining Brokers whereby American Comstock acquired a 100% interest in the project, conducted a diamond drilling program.

At the Corey property, 10 km south of the high-grade Eskay Creek gold-silver-zinc-copper mine, Kenrich Mining Corporation drill tested the T.V., Cumberland and Bench zones. An airborne magnetic and radiometric survey was completed. A major drilling program is planned for 1997.

During 1996, Sultan Minerals Inc. conducted surface and underground drilling programs in three zones on its Jersey-Emerald stratabound sulphide deposits near Salmo.

Exploration - Skarns and Other Deposits

In the Greenwood camp, Orvana Minerals Corporation and Teck Corporation entered into a 40/60 joint-venture agreement to further explore Orvana's Eholt copper-gold skarn target. A drilling program was completed.

In north-central British Columbia, Vital Pacific Resources Ltd. (74%) and Athlone Resources Ltd. (26%) completed a drilling program on their Soup gold-copper property.

Bren-Mar Resources Ltd. completed an aerial magnetic survey and preliminary drilling on its Turnagain River nickel, cobalt and copper ultrabasic-hosted deposit east of Dease Lake.

Gold City Mining Corporation, Phoenix Gold Resources Ltd. and Orion International Minerals Corporation are examining and evaluating the Old Nick nickel-cobalt prospect in the Rock Creek area for its low-grade, bulk tonnage heap-leach potential. A drilling program was completed and, in August, an option agreement was signed with Canadian Mine Services Ltd. and Monument Mining Corp.

Initiatives for Exploration and Mining in British Columbia

Funding for development of the Kemess South project includes an economic assistance and investment package of up to $166 million from the B.C. government negotiated in compensation for the Windy Craggy decision.

The Prospectors' Assistance Grant Program is designed to promote grassroots prospecting for new mineral deposits in British Columbia. It contributed up to 75% of eligible costs of an approved project to a maximum of $10 000. Sixty-eight grants were awarded in 1996 from a budget totalling $500 000. In 1997, 47 grants have been confirmed.

The Geological Survey Branch programs focused on regions where significant mineral potential is indicated (Gataga North, Yukon-Tanana Terrane (B.C.), French Range, Toodoggone Southeast-McConnell, Babine, Sitlika, Northern Selkirks, Tatogga Lake, Kootenay Terrane, Bella Coola and East Kootenays). A project was completed examining the metallogeny of the Rossland camp; a new project was initiated examining the potential for bulk tonnage gold deposits. Several smaller-scale projects were carried out on coal and industrial minerals. Results of these programs are expected to encourage base- and precious-metal exploration in these areas and elsewhere.

The Mineral Potential Mapping Initiative will see the completion of 1:250 000-scale mineral potential

maps for the province in 1996, with the last area to be completed being the northwest sector. These data are being referred to in many land-use decisions.

A recently completed British Columbia Geological Survey Branch project measured methane in core samples in the Tsable River area. The data provide information for an assessment and mine safety of coal bed methane resources in this area.

An inventory of sand and gravel resources was carried out by the Geological Survey Branch and will assist the Ministry in managing the aggregates resources in the province.

The Federal-Provincial B.C. Geoscience Co-ordinating Committee continued close liaison regarding the implementation of geoscience programs of the Geological Survey of Canada and the British Columbia Geological Survey Branch.

A second open file on the "Mineral Deposit Profiles" was published. This brings the total of published metallic deposit types to 60. Short courses on parts of the project were delivered at Cordilleran Roundup 1996 (Vancouver) and the Northwest Mining Association Conference 1996 (Spokane, Washington).

The Intergovernmental Geoscience Accord, which strengthens the federal-provincial geoscience activities in a collaborative manner, was signed in 1996.

Discussion continued with First Nations, spearheaded through the Treaty Commissions in British Columbia that are designed to provide them with a more equitable role in mineral exploration and development decision-making within their traditional territories.

The Nechako Plateau-Babine Porphyry Belt NATMAP program by the Geological Survey Branch and the Geological Survey of Canada in the Nechako River (93F), Fort Fraser (93K) and parts of the Smithers (93L) and Prince George (93G) map areas was in full swing as part of a five-year project.

The results of the East Kootenay multi-parameter airborne geophysical survey, funded by the provincial government and covering two blocks surveyed in 1995, were released on July 11, 1996; a third block (Yahk-Creston) was flown in the fall of 1996 and the results were released in early 1997. Several new claims were staked, primarily targeting Sullivan-type targets.

The release of RGS data of the Cry Lake (104I) map sheet on July 4, 1996, resulted in numerous

claims being staked. During the summer of 1996, similar surveys were completed in the Toodoggone River (94E) and McConnell Lakes (94D) map sheets; the results will be released on July 16, 1997. During the summer of 1997, the Mesilinka Sheet (94C) will be sampled. The results will be released in July 1998.

The Ministry continued working on a comprehensive review of mineral exploration practices and permitting procedures to develop standards compatible with the Forest Practices Code. The new Mineral Exploration Code is expected to be implemented in 1997.

The Ministry participated in an inter-agency study concerning placer mining in the province.

Conclusion

In mid-1996, British Columbia's current administration stated that its predominant focus will be on job creation, education and health. As a result, there is a much enhanced emphasis on the growth of the mining sector in B.C.

Increasingly, it is recognized that mining in this province has a commendable safety record compared with other industries, it requires strong technical and sophisticated management skills, and it is one of the leaders in stimulating beneficial economic impacts since the average compensation package per employee is $73 900 (in 1996) and each direct job creates at least two additional ones.

Issues concerning the security of exploration property tenure and an expedient environmental assessment process are being examined. First Nations treaty negotiations and the land use processes have evolved into

more mature phases where clearer outcomes are anticipated and several government initiatives are focused on facilitating efficient environmental assessments.

The medium- to long-term outlook for mineral markets is very good throughout the Pacific Rim. With British Columbia's highly mineralized terranes, solid track record as a mining jurisdiction and abundant technical, financial and managerial expertise, the province is well positioned for future exploration and development.

5.11 NORTHWEST TERRITORIES

1996 Activities

The most significant change in 1996 within the Government of the Northwest Territories (GNWT) was the creation of the Department of Resources, Wildlife & Economic Development (RWED) by the amalgamation of the departments of Renewable Resources, Energy, Mines & Petroleum Resources, and Economic Development & Tourism. Within RWED, the Minerals, Oil & Gas Division has responsibility for non-renewable resources development and activities. The new department will provide, on behalf of the GNWT, one-stop shopping for resource and economic development activity in the Northwest Territories (N.W.T.). It provides the GNWT with the ability to coordinate resource and economic development activities while addressing environmental concerns and issues.

One of the first tasks facing the new department is the development of a Protected Areas System (PAS) for the N.W.T. The GNWT, in conjunction with the federal department of Indian Affairs and Northern Development (DIAND) and Aboriginal land claim organizations, began work in 1996 on developing a PAS for the N.W.T. While work progresses on the PAS, RWED recognizes that the development of a PAS is part of the Whitehorse Mining Initiative (WMI). RWED is working to address other issues and concerns of the mining industry that are also part of the WMI.

In 1996, the federal Cabinet approved Canada's first diamond mine. The N.W.T. diamond project's Koala mine is scheduled to begin production of gem diamonds in the fall of 1998. The GNWT recognizes diamonds as a new industry in the North and one that has the potential to be a long-term contributor to the North's economic development, and is working to ensure that the benefits from the diamond developments remain in the North.

1996 Production Summary

Preliminary figures for 1996 show that the N.W.T. supplied 4.4% of the total value of Canada's metallic minerals. The operating mines in the N.W.T. produced 15.5% of Canada's zinc, 8.2% of its gold, 11.6% of its lead and 1.9% of its silver.

The preliminary value of metallic minerals shipped from N.W.T. mines decreased slightly from $531 million in 1995 to $521 million in 1996. Zinc and gold continue to be the leading commodities produced in the N.W.T.

The value of gold shipments decreased from $244 million in 1995 to $221 million in 1996. However, the N.W.T. still remains the fourth largest gold producer in Canada. The gold produced formed 42% of the value of the N.W.T.'s metallic mineral production in 1996. Zinc remains the N.W.T.'s most valuable commodity, as its 1996 value of $256 million represents 49% of the total value of the N.W.T.'s metallic minerals. The 1996 value of zinc shipments increased slightly from 1995's figure of $255 million. The total tonnage produced increased slightly from 180 000 t in 1995 to 184 000 t in 1996. The N.W.T. was Canada's third largest producer of zinc in 1996.

Lead shipments continued to decline slightly from 31 000 t in 1995 to 28 000 t in 1996; however, the value of lead increased to $30 million in 1996, up from $27 million in 1995.

1996 Exploration Summary

The Northwest Territories was first in Canada in exploration expenditures for the third straight year. Expenditures rose from $172 million in 1995 to a preliminary value of $183 million in 1996. Exploration expenditures in the N.W.T. have been increasing for the past six years.

Over 3800 claims covering an area of 3.4 million ha were staked in 1996. The number of claims in good standing as of March 1997 were 17 213 totalling over 14.3 million ha, a slight decrease from the same time last year. A total of 549 prospecting permits were issued in 1996; these permits covered a total area of 11.5 million ha in the Arctic Islands (primarily Victoria, Baffin, and Devon Islands), the northern Keewatin, and the Cordillera/Mackenzie Mountains.

The BHP/Dia Met N.W.T. diamonds project (51% BHP Minerals Canada Ltd., 29% Dia Met Minerals Ltd., 10% C. Fipke, 10% S. Blusson) in the Lac de Gras area, 300 km northeast of Yellowknife, continued to be the most advanced diamond project in Canada through 1996 and into 1997. The full EARP (Environmental Assessment and Review Process) review continued in 1996; public hearings and consultations were held early in the year and the Panel's recommendation in support of the project was announced in June. On September 20, 1996, the board of directors at BHP's head office in Australia officially approved the US$750 million project, pending the granting of all legislative and regulatory approvals. BHP secured water permits and land leases in October in order to begin some on-site construction. During the fall of 1996, BHP concluded agreements with the GNWT (socio-economic), DIAND (environmental), Treaty 8, Treaty 11 and Kitikmeot Inuit (Impact and Benefits Agreements). Negotiations between BHP and the Metis continued into 1997. Full-scale construction commenced following the transport of materials by the 1997 winter road; in excess of 2000 truckloads have reached the site. Documents for official approval by the federal government were signed in Yellowknife on November 1, 1996. Production is scheduled to begin in late 1998. BHP is examining options for marketing the diamonds and a decision on marketing is expected in the fall of 1997.

The mine will process 133 Mt of ore from five kimberlite pipes over 17 years by both open-pit and underground mining methods. A probable mine life of 25 years is predicted with the discovery of additional pipes on the property. A total of 77 kimberlites have been found on the claims; 20 of these have been sampled, and 5 have been chosen for initial production. **Table 12** lists the attributes of these pipes.

The Panda pipe will be the first to be mined, with the four other pipes coming on stream later in production. The projected annual cash flow of the mine is US$230 million to US$270 million. About 1000 jobs will be created during the construction of the mine. Approximately 830 employees will be required during full production; two thirds will be Northerners, and half of this portion will be comprised of Aboriginal people. It is estimated that over 650 indirect jobs will be created by the project.

The potential of the Diavik joint-venture property, owned 60% by Diavik Diamond Mines Inc. (formerly Kennecott Canada Inc.) and 40% by Aber Resources Ltd., continues to grow. A total of 45 kimberlite pipes have been discovered on the property and four pipes (A-154 North, A-154 South, A-418 and A-21) are being considered for mining. A two-year $80 million bulk sampling and prefeasibility study is under way and will be completed in the fall of 1997. If economic, these four pipes may be combined into a single mine; the A-154 North and South pipes would be mined in an open-pit operation as they are only 250 m apart. The 5000-t/d mining operation could possibly begin in the year 2000. All four pipes have been mini-bulk sampled by large-diameter core drilling in order to establish an estimate of grade. In addition, underground bulk samples at both the A-154 South and A-418 pipes have been completed in order to accurately determine the per-carat value of the diamonds. Results of these valuations are expected in mid-1997.

Lytton Minerals Ltd. and New Indigo Resources Inc. are directing $23 million to the bulk sampling and development of three Jericho kimberlite pipes on their one-million-acre property. The JD/OD-1 pipe is land-based and is located only 20 km north of Echo Bay Mines Ltd.'s Lupin mine site. A diamond recovery plant for the processing of Jericho bulk samples at Lupin has been constructed. Approximately one third of the 15 000-t bulk sample extracted from this pipe in 1996 has been processed at the Lupin plant; 6500 carats have been recovered thus far, yielding a grade of 1.287 ct/t. Valuation of these diamonds is to follow directly. Pipe JD/OD-1 is estimated to contain 15 Mt to a depth of 750 m. Continued processing of the bulk sample will be followed by a feasibility study, if results are favourable.

Exploration is also being conducted on several new diamond projects. Geophysical surveys, till sampling and exploratory drilling are being carried out on kimberlite targets in the Mackay Lake/Back Lake area, 250 km northeast of Yellowknife, by Kalahari Resources and SouthernEra Resources. Till sampling and airborne geophysical surveys have identified five drill targets on Caledonia Mining's Kikerk diamond project; Portree has optioned this property. Kimberlite was intersected by Gerle Gold at Doyle Lake in 1996; follow-up drilling will be conducted this year by Monopros under an option agreement. Winspear Resources and Aber Resources have also drilled kimberlite in the Snap Lake area of the Camsell Lake diamond project. Highly diamondiferous kimberlite boulders and anomalous concentrations of diamond

indicator minerals were discovered there in late 1996; follow-up exploration resulted in successful drilling. The exploration program will continue through 1997.

BHP Minerals Canada Ltd.'s Boston prospect is an advanced gold property 170 km south-southwest of Cambridge Bay. Permits were granted to conduct an underground sampling program in 1995 and a 1000-m underground decline was constructed in 1996 to bulk sample some 13 000 t of ore. Over 50 700 m have been drilled at the Boston project to date. If a gold mine were to be developed, BHP reports that it would be a 1700-t/d operation supplied by a 70-kilometre-long road from a port on the Arctic Coast.

Echo Bay Mines Ltd.'s Ulu gold deposit will be developed as a satellite deposit of its Lupin mine, located 160 km to the south, in order to keep mill feed levels constant. The Ulu ore will be stockpiled and trucked to the Lupin mill for processing via winter road. Production is to begin during the 1998 winter road season.

Arauco Resources Corp. purchased the George Lake and Back River gold properties, located about 240 km northeast of Yellowknife, from Homestake Canada in 1996. A 20 000-m in-fill drilling program to better outline the mineralized zones and exploration for additional resources are planned for the summer of 1997.

GMD Resource Corp.'s 1996 drilling program at the Discovery mine property, located 100 km northeast of Yellowknife, yielded multiple high-grade gold intervals within the Ormsby zone. Several other targets have been identified on the claims and follow-up work will be conducted in 1997.

At the Damoti Lake iron formation-hosted gold property, located 150 km northwest of Yellowknife, Quest International Resources completed underground exploration that tested the extent of the Horseshoe zone. Canadian American Resources purchased 50% of the property in 1996 for US$12 million; US$7.2 million of this will be spent on further work. The 1997 spring drilling program is testing targets outside the Horseshoe zone to expand the project's gold resource now totalling 1.45 Mt grading 9.22 g/t gold, and within this zone to upgrade its current gold inventory of 14 705 t grading 31.5 g/t gold. Another gold prospect in the area, the Fishhook Lake property to the south, is being actively explored by Gitennes Exploration. Placer Dome has optioned this property and will spend $3.4 million on the property over the next four years to earn a 55% interest.

The NICO polymetallic property in the Mazenod Lake area, 160 km northwest of Yellowknife, continues to be evaluated by Fortune Minerals; various geophysical surveys, detailed geological mapping, and over 6000 m of drilling were completed in 1996. The drill-indicated resource for the Bowl zone is 41.6 Mt of ore grading 0.834 g/t gold, 0.102% cobalt, 0.106% bismuth, 0.045% copper, and 0.034% tungsten oxide. Fortune's 1997 drill program will consist of over 15 000 m on claims in the Mazenod Lake area. One drill will further test the Bowl zone, and another will be located 30 km to the north at the Sue-Dianne deposit (8.2 Mt grading 0.8% copper and 5.52 g/t silver), which Fortune optioned from Noranda in early 1996. A third drill will be operated by Fortune at GMD Resource Corp.'s Treasure Island claims group, which adjoins the NICO claims at their southeast boundary.

Firesteel Resources continued work on its polymetallic Kap property in the Cordillera; the company completed exploratory drilling, mapping and soil geochemistry in 1996.

The Meliadine gold property, located only 20 km north of the community of Rankin Inlet, continues to be the most advanced mineral exploration project in the District of Keewatin. Equal partners Cumberland Resources Ltd. and Comaplex Resources Corp. drilled over 6000 m on the eastern half of the property (Meliadine East) in 1996, returning favourable results. At Meliadine West, WMC International Ltd. has spent approximately $10 million to date on exploration under an option agreement with Cumberland and Comaplex. WMC's 1997 winter program was comprised of 15 000-20 000 m of drilling in order to test the TC, Tiriruniak East, F, and Wolf gold zones.

Joint-venture partners Cumberland (60%) and Comaplex (40%) continued drilling in 1996 on gold-bearing zones at the Meadowbank property, located 80 km north of Baker Lake. A 1997 drilling program has been planned to increase gold resources in preparation for a prefeasibility study.

Cogema Resources continued its exploration work for uranium in the Schultz Lake area, 100 km east of Baker Lake, in 1996. Geological mapping, drilling and geophysical surveys were completed.

International Capri Resources Ltd. prospected and conducted ground geophysical surveys on its Burning Bush zinc showing on Cumberland Peninsula on south-central Baffin Island. Also on Baffin Island, Phelps Dodge Corp. of Canada Ltd. prospected for nickel and copper near Lake Harbour, and Cominco sampled base-metal showings near Pond Inlet.

BHP explored for base metals on Devon Island; a few lead-zinc and copper showings were discovered.

Monopros collected till samples and conducted aeromagnetic surveys on its Victoria Island and Banks Island diamond exploration properties. Base metals were the target of WMC's exploration activity on Victoria Island in 1996; regional mapping, geochemical sampling and ground geophysics were completed.

Cominco drilled and completed geophysical surveys in the vicinity of its Polaris mine site on Little Cornwallis Island in search of additional lead-zinc reserves. The company was also active on Dundas, Cornwallis and Somerset Islands.

5.12 YUKON

Overview

Exploration expenditures in 1996 surpassed the 1995 total by 37% to reach $54.8 million. Approximately 60% of the expenditures were spent on the search for base metals, a significant portion of the total in the Finlayson Lake area, and the remaining 40% was spent on the search for precious-metal deposits.

Mining development expenditures were $54.1 million in 1996, slightly lower than the $57 million spent in 1995. Development occurred mainly at the Brewery Creek and Mt. Nansen properties, which both produced their first gold bars in November 1996. Development expenditures were also incurred at the Minto project (a copper-gold-silver porphyry deposit), Carmacks Copper, Kudz Ze Kayah in the Finlayson Lake area, the Laforma gold mine project, and at the Faro property.

New quartz claim staking reached a staggering level with 22 685 claims staked by the end of 1996. Never in the history of the Yukon have this many claims been staked in a single year. The high level of new claims recorded over the last three years has resulted in quartz claims in good standing also reaching an historic high of 72 190. The high level of claims and continued exploration success in the Yukon point toward a healthy exploration industry for the foreseeable future.

Over 100 exploration projects were conducted in 1996. The Finlayson Lake area received close to 50% of all exploration expenditures in 1996, but the search for bulk tonnage gold deposits in the Yukon also accounted for a significant proportion of the expenditures. Thirteen different projects spent over one million dollars in the Yukon. These included programs at Faro, Fyre Lake, Cominco and Expatriate (both in the Finlayson Lake area), Dublin Gulch, Brewery Creek, Marg, Goddell, Skukum Creek, Laforma, Keno and Wolverine, and by Yukon Gold Corp. in the Emerald Lake area. Grassroots reconnaissance exploration also resulted in significant activity in the Yukon in 1996. One program, financed by a private consortium, identified several multi-element geochemical anomalies based on detailed stream sediment sampling and prospecting, and resulted in the staking of roughly 2000 claims in the Brewery Creek area.

The following are the highlights for 1996:

- There were three mining operations in the Yukon, including: Anvil Range Mining Corporation's Grum and Vangorda mines (lead, zinc, silver) at Faro, Viceroy Resource Corporation's Brewery Creek mine (heap leach gold), and B.Y.G. Natural Resources' Mt. Nansen mine (gold, silver).
- Exploration and mine development expenditures surpassed $108 million, continuing the upward trend that began in 1992.
- A new massive sulphide lens, the Lynx, was discovered late in the season on the Westmin/Atna Resources Wolverine property, significantly adding to reserves.
- A significant massive sulphide body was revealed on the Fyre Lake property of Columbia Gold Mines Ltd. as a result of the first substantial drill program conducted on the property since its discovery in 1960.
- Massive sulphides were intersected on the Ice claims of Expatriate Resources Ltd. in the final hole of the drill program in an area previously believed to host insignificant mineral potential.

1996 Production Summary

Anvil Range Mining Corporation completed its first full year of production at the Faro property since re-opening in 1995. Approximately 346 000 t of zinc concentrate and 186 000 t of lead concentrate were produced from the Grum and Vangorda mines. Mining operations were suspended on December 20, 1996, due to weak zinc and lead prices, the strengthening Canadian dollar and lower-than-expected production levels.

The first gold bar at the Brewery Creek mine was poured on November 15, 1996, and production through the first winter is estimated at 10 000-15 000 oz. This mine, owned by Viceroy Gold Corporation, is the largest heap leach gold operation in Canada and the northernmost heap leach gold mine in North America.

Gold production from the Mt. Nansen mine commenced in October and B.Y.G. Natural Resources poured its first bar of gold on November 23, 1996. The company expects to produce about 50 000 oz of gold in the first year of operation.

1996 Development and Advanced Exploration Summary

Several projects are undergoing environmental review and, when permits are obtained, will add to the growing base of operating Yukon metal mines.

Minto Explorations Ltd. focused all of its efforts on the development of the Minto project (copper-silver-gold) in central Yukon. A joint-venture agreement with Asarco Inc. was completed to bring the project into production. The company also conducted geotechnical programs and a small drilling program on the margins of the existing orebody.

Cominco Ltd. continued to develop Kudz Ze Kayah, the first significant volcanic hosted massive sulphide discovery in the Finlayson Lake area. Work in 1996 consisted of continued engineer-ing, metallurgical and environmental studies on the ABM open-pit deposit. Cominco and the Ross River Dena Development Corp. signed a socio-economic participation agreement in May 1995.

Western Copper Holdings Ltd. and Thermal Exploration Company amalgamated to form Carmacks Copper Ltd., a company solely committed to advancing the Carmacks copper project to production. The company continued geotechnical work on the property in 1996 in an effort to complete permitting of this low-grade heap leachable copper deposit.

New Millennium Mining Ltd., a wholly owned subsidiary of First Dynasty Mines Ltd., continued to develop the Dublin Gulch property, an intrusive-hosted gold target in central Yukon. In 1996, over 7000 m of diamond and reverse circulation drilling was conducted to further define a high-grade zone within the reserves, upgrade inferred reserves, and expand existing reserves to the north and west. With successful completion of permitting and a final feasibility study, this heap leach project is expected to make a production decision in 1997.

United Keno Hill Mines Ltd. continued underground exploration on its Keno Hill silver properties in central Yukon. The main focus was additional reserves and underground development in the former Bellekeno and Silver King mines. The First Nation of Nacho Nyak Dun has given conditional environmental approval to the draft operating and closure plans prepared by United Keno Hill in connection with its plan to resume commercial production of silver from Elsa.

Exploration

The largest exploration program in the Yukon was conducted on Westmin Resources Ltd.'s (60%) and Atna Resources Ltd.'s (40%) Wolverine polymetallic deposit. The 1996 exploration program focused mainly on definition drilling of the Wolverine deposit and a regional strati-graphic drill program. An airborne geophysical survey, regional mapping, geochemical surveys, and construction of a 1000-m airstrip were also completed. The result of the program was the discovery of a new massive sulphide lens, the Lynx zone. The Lynx zone adjoins the Wolverine zone to the west; is, on average, thicker and higher grade than the Wolverine zone; contains an upper massive sulphide lens; and remains open to the south and west.

Columbia Gold Mines Ltd. completed a major exploration program on the Fyre Lake copper-cobalt- gold

volcanic hosted massive sulphide property. The program consisted of geological mapping, geochemical and geophysical surveys, and 9531 m of diamond drilling in 71 holes.

Expatriate Resources Ltd. holds over 5400 claims in the Finlayson Lake area and was very active in 1996, conducting exploration for massive sulphides on 24 separate properties. High-grade secondary oxide mineralization was discovered on the Ice property. The 1996 program consisted of diamond drilling, ground geophysics, geochemistry, mapping and prospecting. The discovery of massive sulphides on this property in mafic volcanic rocks of the Campbell Range Belt indicates a new style of volcanic hosted massive sulphide mineralization.

The largest volcanic massive sulphide exploration program outside of the Finlayson Lake area was conducted on the Marg deposit of NDU Resources Ltd. NDU completed 29 holes to test the down-dip and down-rake extensions of the known zones as well as fill-in drilling to upgrade possible reserves to the drill-indicated category.

In southwestern Yukon, several properties in the Kluane area were explored for ultramafic hosted copper-nickel-platinum group elements potential. Northern Platinum Ltd. performed percussion drilling on the Wellgreen deposit and Inco Limited flew an airborne geophysical survey over its KLU claims in the Nines Creek area, near Burwash Landing.

YGC Resources Ltd. explored the Ketza River mine property with detailed geological mapping, prospecting, core-relogging and a diamond drilling program. A total of 5570 m were drilled in 35 holes in the vicinity of the former mine workings and at the bulk-tonnage low-grade gold target, the Shamrock zone.

Omni Resources Inc. collared a portal on the Goddell gold project south of Whitehorse. A 620-m decline was driven parallel to the Goddell Shear zone to establish underground diamond drilling stations and to provide future haulage access. Omni also completed a 15-hole under-ground drill program on the Skukum Creek polymetallic vein deposit south of Whitehorse. The drilling was successful in expanding the deposit, which remains open in several directions.

Placer Mining

Placer gold mining continues to be a major industry in the Yukon, as it has been since the Klondike gold rush of 1898. Production to the end of 1996 was 109 478 crude oz valued at over $46 million. This is a 14% decrease over 1995. In 1996, approximately 171 placer mines were operating in the Yukon.

Exploration and Development Forecast for 1997

The Yukon Chamber of Mines conducted a survey of exploration companies doing work in the Yukon during 1997. Twenty-five companies responded with expenditure forecasts on 37 pro-jects. Total forecast exploration expenditures are $37.5 million and total development expenditures are $8.9 million for 1997. These estimates are usually the minimum figures and can optimistically be expected to increase if results are positive. These numbers are down from last year's forecast, especially for development expenditures.

Yukon Government Programs

The Yukon government currently has three programs to encourage the development of the Yukon's mineral and energy resources, the Yukon Mining Incentives Program (YMIP), the Yukon Industrial Support Policy (YISP), and the Energy Infrastructure Loans for Resource Development Program.

Yukon Mining Incentives Program

The Yukon Mining Incentives Program is designed to promote and enhance mineral prospecting, exploration and development activities in the Yukon. The program's function is to provide a portion of the risk capital required to locate and explore mineral deposits. Grassroots programs (Prospecting and Grubstake categories) are conducted on open ground (Crown land) and Target Evaluation programs are conducted on newly discovered prospects and targets covered by mineral claims, placer prospecting leases

and claims, and coal licences and leases. Technical assistance is offered to prospectors upon request.

Program funding for 1996/97 was $430 000. The number of grants approved in each category was 11 in the Grassroots programs and 16 in the Target Evaluation programs.

Yukon Industrial Support Policy (YISP)

The Yukon government recognizes the lack of infrastructure in many regions of the Yukon and this program encourages the development of public infrastructure by the private sector in the Yukon. The Yukon government enters into a development agreement with the resource development sector for projects that require road improvement or construction, energy supply, grid connections, or related training programs for Yukon residents. No projects were approved under this program in 1996.

Energy Infrastructure Loans for Resource Development Program

This program assists the resource development sector in the Yukon by helping to defer the capital cost of building energy infrastructure. The program provides loans to companies to help them create electrical infrastructure to meet their energy needs. No projects were approved under this program in 1996.

6. Historical Review of Mineral Exploration Spending in Canada

6.1 INTRODUCTION

This section presents an historical review of patterns of exploration spending based on results from the federal-provincial survey of mining and exploration companies.

6.2 HISTORICAL SUMMARY

Figure 25 depicts (in constant 1996 dollars) Canadian exploration expenditures over 29 years from 1969 through 1997. Above-normal exploration expenditures in the 1980-82 period resulted from high prices for gold, silver and copper over much of that period. Exploration expenditures declined somewhat in 1983, but generally rose from 1984 to 1988 as a result of the introduction by the federal government, in 1983, of the Mining Exploration Depletion Allowance (MEDA). MEDA was replaced in 1989 and 1990 by the Canadian Exploration Incentive Program (CEIP). By 1987 and 1988, exploration expenditures had reached unprecedented high levels because of MEDA and the high gold prices that had existed until the end of 1987. However, exploration fell dramatically after 1988. Exploration expenditures decreased between 1989 and 1992, when they reached their lowest level since 1967.

Exploration expenditures are continuing to increase from their 1992 low. In 1996 and 1997, they should reach more than twice their 1992 level. The upward surge in expenditures since 1992 has been driven principally by important discoveries of diamond deposits, leading some companies to invest in advanced exploration or deposit appraisal projects. In late 1994, the nickel-copper-cobalt discovery at Voisey's Bay, Labrador, a result of exploration for diamonds in that area, attracted the attention of many mining companies, particularly junior exploration companies. This deposit is potentially the most important base-metal find in Canada in decades. The resulting flurry of exploration activity in the area is likely to be sustained for some time.

6.3 METAL PRICES AND EXPLORATION LEVELS

Stronger metal prices have also helped boost exploration activity, as evidenced by the correlation between exploration expenditures and the metals price index (Figure 26). For example, nickel, copper and lead prices, expressed in Canadian dollars, increased by more than 60% between 1993 and 1995, silver prices increased by about 30%, and both zinc and gold prices increased by 14%. However, during 1996, only lead prices continued to increase and precious-metal prices remained stable, while nickel and copper prices dropped by 10% and 22% respectively; zinc prices were down by only 1%.

Supported by a robust domestic economy, strong U.S. demand, and brighter economic prospects for

Canada's other trading partners, the 1997 outlook for Canada's mining sector has improved relative to 1996. Prices for most base metals so far this year are averaging above 1996 levels and expectations are that, with the exception of lead, 1997 prices will be above the corresponding levels of last year. Copper prices may come under pressure later in the year and in 1998 as new supplies come on stream. Although the outlook for gold fabrication demand is positive, especially in the jewellery sector, potential gold sales by central banks have had a negative effect on the price of gold. As a result, the average price is expected to drop from its 1996 level of US$388/oz to US$335/oz in 1997. The average annual price of gold is expected to be in the US$330-$360/oz range for the rest of the decade.

6.4 EXPLORATION AS PART OF TOTAL MINING INVESTMENT

General exploration, mine-site exploration, mine-site development, other capital expenditures (structures, machinery and equipment), and repairs totalled $4.7 billion in 1995, up from $3.9 billion in 1994 (**Figure 27**). Between 1992 and 1995, the total capital and repair investment increased by 40%. In 1996, capital costs (excluding repairs) increased by 11% over 1995 and, in 1997, experienced a slight decrease of 3% compared to 1996. Repair costs data were not available for 1996 and 1997. However, assuming that they were relatively the same as in recent years, total capital and repair expenditures would likely have reached close to $5 billion in each of 1996 and 1997. As for the total exploration component, it has generally represented about 15% of total mining investment.

6.5 EXPLORATION EXPENDITURES BY PROVINCE AND TERRITORY

Table 13 shows current dollar expenditures on mineral exploration in Canada by province and territory for the 1986-97 period. **Table 14** reports the same information, but in constant 1996 dollars. **Table 15** presents these data as percentages.

From 1986 to 1992, Québec, Ontario and British Columbia were the most actively explored provinces/territories. In 1993, for the first time since 1982, exploration spending in Ontario and Québec combined fell below 40% of the Canadian total, having peaked at 64% in 1987. In 1994 and 1995, the Northwest Territories was the most actively explored Canadian jurisdiction. Preliminary data indicate that it has likely retained that ranking during 1996. The high levels of diamond exploration expenditures have helped boost the Northwest Territories' national contribution to over 20% every year since 1993. These are the highest percentages for the Northwest Territories since Canadian exploration statistics were first collected in 1946. Previously, the Northwest Territories ranked either fourth or fifth nationally.

In 1993 and 1994, Ontario fell to third place behind the Northwest Territories and Québec. However, since 1995, the situation has been improving for Ontario. In 1997, it is likely that Ontario will lead the country in terms of exploration expenditures. Activity has also resumed strongly in British Columbia with an expected increase in exploration expenditures of 91% over the 1993-97 period. In light of British Columbia's improving situation, Québec is expected to fall into fourth place in 1997. As a consequence of the Voisey's Bay exploration rush, Newfoundland and Labrador also improved its national ranking, from eighth in 1994 to fifth in 1995 and 1996, with 10% of total Canadian exploration expenditures. In each year since 1995, between 80% and 90% of Newfoundland and Labrador's exploration expenditures were spent in Labrador.

6.6 EXPLORATION EXPENDITURES BY TYPE OF COMPANY

Figure 28 depicts exploration expenditures (field work plus overhead) by type of company for 1990 to 1996 (preliminary) and 1997 (intentions). Producers and their affiliates usually represent 80-85% of the total senior companies category. In constant 1996 dollar terms, exploration by producing companies and their affiliates peaked in 1987 and 1988, declined until 1992, and started to increase in 1993. In reality, this period of decline may not be as large as it appears because it includes considerable contributions made in the period 1986-88 by junior companies to joint-venture projects operated by senior companies. These contributions were counted as part of senior companies' spending, thus overstating senior expenditures and understating junior expenditures during the period 1986-88. Expenditures by senior companies have continued to increase during 1996, thus showing a total increase of about 77%, in constant dollar terms, for the 1992-96 period. A slight decrease in senior expenditures of about 5% is expected for 1997.

Exploration expenditures by junior companies followed the same pattern as those by senior companies (**Figures 25** and **28**), peaking in 1987 and 1988, then decreasing until 1992 (the lowest amount since

1980), and then increasing again through 1997. This latest increase was initially fuelled by the exploration rush for diamonds that began in 1993 and that is expected to continue through 1997. The search for diamonds contributed about one third of the total junior expenditures in 1993 and 1994, about 20% in 1995 and 1996, and likely 12% in 1997. Roughly 10% of all junior exploration expenditures for each of the years 1995, 1996 and 1997 were a result of the late-1994 Voisey's Bay nickel-copper-cobalt discovery. In 1997, junior company spending intentions are almost four times the junior exploration expenditures reported in 1992. Although junior company exploration expenditures are lower than their high levels of 1987 and 1988, they are still higher than they were prior to 1986.

In 1983, junior companies accounted for about 15% of total Canadian exploration expenditures, but by 1987 this proportion had increased to 51%. In 1988, expenditures by the juniors began to decline. The decline continued through 1992, when the lowest amount since 1980 was recorded. Junior expenditures accounted for 21% of total exploration expenditures in 1992; around 30% in 1993, 1994 and 1995; 35% in 1996; and an expected 38% in 1997.

6.7 EXPLORATION EXPENDITURES BY TYPE OF COMMODITY SOUGHT

Exploration for precious metals (95% of which was for gold) peaked in 1987 (**Figure 29**) and subsequently declined as the availability of flow-through share capital decreased and as the gold price declined after the end of 1987. Expenditures for precious metals rose again during 1993, 1994 and 1995. The gold price was also up during those years.

Exploration expenditures for base metals were lowest in 1986. They increased until 1990 when they exceeded the lowest level of the late 1970s. Exploration for base metals declined again in 1991 through 1993. During 1992, the decrease in precious-metal exploration was much more severe (46%) than in base-metal exploration (17%). Consequently, total expenditures for base-metal exploration exceeded those for precious metals for the first time since 1983. By October 1993, the inflation-adjusted prices of nickel, copper, zinc and lead were at all-time lows. They have recovered quite strongly since then, leading to increases in base-metal exploration expenditures. In fact, between 1993 and 1995, base-metal exploration increased by 45%.

In 1987 and 1988, exploration expenditures for all non-petroleum mineral commodities other than base and precious metals (**Figure 29**) accounted for only about 5% of total Canadian exploration expenditures. In 1989 and 1990, expenditures directed at other mineral commodities (excluding uranium) more than doubled in percentage terms, but did not actually increase significantly in constant dollar terms. In 1991, expenditures for "others" (excluding uranium) reached a low, in both percentage and constant dollar terms. They increased again in 1992, both in percentage and in dollar terms, and they increased significantly in 1993 to reach between 25% and 27% of the total expenditures for three years in a row ($125 million in 1993, $173 million in 1994 and $197 million in 1995). The search for diamonds mostly contributed to the increase in the level of expenditures in this "other" minerals and metals category.

6.8 EXPLORATION AND DEVELOPMENT EXPENDITURES BY FOREIGN-CONTROLLED FIRMS

Foreign companies have long recognized Canada's mineral potential and have been contributing significantly to both exploration and development in Canada. The federal-provincial survey of mining and exploration companies reveals that, since 1989, foreign-controlled companies have accounted for about 28% of the spending on exploration and 26% of the spending on mine development in Canada.

In 1996, foreign firms spent some $268 million (**Figure 30**) on mineral exploration in Canada, more than double, in constant dollar terms, the $125 million that they spent in 1992. Exploration expenditures by foreign-controlled companies are expected to drop slightly to $246 million in 1997. In terms of development expenditures, spending by foreign firms reached $204 million in 1996 and is forecast to increase to $219 million in 1997.

Actual amounts spent by foreign firms on exploration and development in Canada are likely higher than those reported in the federal-provincial survey because many foreign firms do not have a controlling interest in the Canadian-based partnerships in which they participate. As a result, expenditures from these partnerships are reported to the survey under the name of the controlling Canadian partner (project operator) and are counted as expenditures of Canadian companies.

7. Canada's Standing as a World Exploration Target

7.1 INTRODUCTION

In 1995 and 1996, and most probably again in 1997, Canada remained one of the world's top mineral exploration targets, ranking second (after Australia) in each of those three years, thus continuing the close contest of the past three or more decades between those two countries.

The United States, based on the limited and poor-quality exploration statistics available for that country, appears to have been a strong contender for first place up until about 1980, but has been consistently in third position since then.

Based on official Canadian and Australian government surveys of company exploration expenditures, Canada ranked first every year from 1981 through 1990 and was probably also first in 1991. Canada ranked second, after Australia, from 1992 through 1996 (**Figure 31**). In 1996, and most likely in 1997, Australia and Canada continued their close contest for the world's top destination for exploration capital from worldwide sources. In fact, 1996 exploration expenditures in each of Australia and Canada were much greater than those in any other single country. This is also expected to be the case in 1997.

7.2 DISCREPANCIES BETWEEN EXPLORATION SURVEY RESULTS

In recent years, there has been considerable confusion concerning Canada's relative share of worldwide non-petroleum mineral exploration activity. Discussion has centred around the results of the proprietary annual survey of worldwide mineral exploration budgets prepared by the Metals Economics Group (MEG) of Halifax, Nova Scotia. Data from this partial survey have generally ranked Canada considerably lower than do the much more comprehensive official Canadian exploration statistics. MEG ranked Canada first in 1991, third in 1992, fourth in 1993, fifth in 1994, third in 1995 and third again in 1996 (after Latin America and Australia), whereas Canada's actual position was first in 1991 and second in all subsequent years.

The MEG survey of exploration budgets for 1996 covers almost all countries. It is a useful source of data because Canada and Australia are the only two countries that have official comprehensive government-run surveys of non-petroleum mineral exploration expenditures. Despite being incomplete, the MEG survey provides the only source of information, for all other countries, on the worldwide exploration activities of the world's larger companies.

For the United States, the exploration expenditure statistics available in the public domain for the years 1970 through 1979 are only rough estimates (from a paper by Schreiber and Emerson, 1984). As a result, the relative position of the United States among the top three contenders for global exploration investment (**Figure 31**) is especially uncertain for those years. Exploration statistics for the United States for the years 1980 to 1991 are derived from incomplete annual surveys carried out by the American Bureau of Metal Statistics Inc. (ABMS) on behalf of the Society of Economic Geologists. The ABMS survey no longer yields useful exploration statistics. Therefore, since 1992, the MEG survey, with its limitations, has been the only source of aggregate exploration statistics for the United States.

Statistics from Canada's annual federal-provincial survey of mining and exploration companies provide a much more complete source of information for ranking Canadian exploration activity than does the MEG survey, as do similar statistics gathered and published by the Australian Bureau of Statistics for ranking Australian activity. More than 98% of the companies targeted by the Canadian federal-provincial survey of mining and exploration companies return their questionnaires completed. The great majority of the companies that fail to respond to the survey do not appear to have substantial exploration programs, so it is likely that more than 99% of total exploration expenditures in Canada are gathered by this federal-provincial exploration survey. It may happen, in rare instances, that some companies are not surveyed because neither the federal nor provincial governments are aware that they are engaged in mineral exploration in Canada.

7.2.1 Differences Between Canadian and Australian Exploration Statistics

Official Canadian and Australian exploration expenditure statistics are not completely comparable

because Australian exploration statistics include some costs that are excluded from Canadian statistics. Canadian exploration statistics exclude all expenditures at producing mines directed at the search for extensions, to depth and laterally, of the orebodies being mined. Such expenditures are included in "development expenditures." Only exploration for a new mine (additional deposit) on the property of an existing mine is counted as exploration expenditures in Canada. In Australia, on the other hand, all expenditures involved in the search for additional ore on production leases, including expenditures on such work in producing mines, are included in "exploration expenditures," whereas in Canada at least some of this work would be counted as "development."

As a result, Australian exploration expenditure statistics are somewhat inflated relative to Canadian exploration expenditure statistics. This is demonstrated by the fact that, over the most recent six years for which Australian exploration statistics are available (fiscal year 1990/91 to fiscal year 1995/96 inclusive), exploration expenditures on production leases averaged 22.1% of total exploration expenditures in Australia, while in Canada, over the eight calendar years 1990 to 1997 inclusive (including "preliminary" 1996 and "company spending intentions" 1997), "on-property" or "mine-site" exploration averaged only 12.9% of total exploration expenditures. In Canada, such expenditures can be anywhere on a company's entire property surrounding its mine, not only on ground equivalent to the more restricted Australian "production leases." If Canadian "on-property" exploration expenditures were reported and compiled using the Australian system, some of these Canadian expenditures would not be included as "production lease" expenditures but as exploration expenditures not on production leases, so that the Canadian percentage would be significantly lower than 12.9% and the percentage difference would be actually greater than the 22.1% in Australia minus the 12.9% in Canada.

These percentages differ for many reasons. What is clear is that aggregate mineral exploration expenditures reported for Australia are higher by an unknown but significant amount, relative to how the same exploration expenditures would be reported in Canada because of structural reporting differences. Therefore, in recent years, exploration expenditures in Australia have not exceeded exploration expenditures in Canada as much as a comparison of each country's respective statistics would suggest.

The value of Australian production of non-petroleum minerals is roughly one third greater than that of Canadian production. For this reason alone, it would be normally expected that annual exploration expenditures in Australia exceed annual exploration expenditures in Canada.

7.2.2 Differences Between Official Canadian Exploration Statistics and Metals Economics Group Exploration Statistics for Canada

The annual exploration statistics produced by MEG substantially understate Canada's share of worldwide exploration activity. There are several reasons for this. First, MEG's results account for only two thirds or less of total exploration expenditures in Canada. In 1996, this survey covered only 76 companies exploring in Canada, a number that is substantially less than the 647 companies that were actually engaged in mineral exploration in Canada that year. Second, for survey years 1993 to 1995, MEG used ever-increasing exploration budget cut-offs to limit the universe of companies it had to survey. There was a slight decrease to US$2.9 million in 1996 from US$3 million in 1995. For 1994, the cut-off was US$2 million, and in prior years it had been US$1 million. Because of these exploration budget cut-offs, the MEG survey has consistently and substantially underestimated exploration activity in both Canada and Australia. This is because, at least until recently, the contribution made by junior exploration companies has been so much greater in Canada and Australia than it has been in all other countries. Canada and Australia both have hundreds of producing or non-producing (junior) companies that individually have spent less on exploration annually than the MEG cut-off but that, as a group have accounted for, and still account for, a substantial amount of domestic exploration activity in Canada and Australia.

In 1996, MEG reported aggregate exploration budgets for Canada of US$460.8 million on the basis of 76 company returns. A company-by-company comparison of the companies surveyed by MEG for 1996 with individual company spending intentions for Canada from the 1996 federal-provincial survey of mining and exploration companies shows that some 571 companies with exploration expenditures in Canada were not covered by the MEG survey. According to Canadian federal-provincial statistics, these companies had planned to spend US$241.5 million exploring for the commodities covered by the MEG survey. The resulting underestimation of total exploration activity is most likely greater in the case of Canada (with US$460.8 million of exploration expenditures in 1996 according to MEG) than in the case of Australia (with US$665.9 million of exploration expenditures in 1996 according to MEG) because there are more juniors engaged in exploration in Canada than there are in Australia.

Of the US$241.5 million of exploration expenditures in Canada not picked up by MEG, some US$63

million was to be spent by 13 companies, each of which had reported, to the federal-provincial survey, planned 1996 exploration expenditures in excess of the 1996 MEG survey cut-off of US$2.9 million. None of these 13 companies appear to have been surveyed by MEG. This means that MEG presumably should have reported Canadian exploration expenditures of about US$524 million for companies with exploration expenditures of US$2.9 million or more, and not the $460.8 million actually reported. The possibility exists that this may in part be because some companies, which had reported planned exploration expenditures to the federal-provincial survey early in 1996 exceeding the MEG cut-off, subsequently revised their 1996 spending intentions downward by the time they were contacted by MEG.

Furthermore, the MEG survey does not cover exploration for all of the mineral commodities sought by companies (e.g., uranium). Company spending intentions for uranium exploration in Canada during 1996 amounted to about 25% of total world uranium exploration expenditures for 1996 (as compiled by the International Atomic Energy Agency), a larger world share than the 13.1% that Canadian exploration expenditures (for the commodities covered by the MEG survey) constitute of world exploration expenditures reported by MEG. Therefore, Canadian exploration budgets reported by MEG are underrating Canadian exploration efforts by excluding uranium from the commodity groups surveyed. However, in addition to uranium, exploration expenditures for all of the other commodities not covered by the MEG survey (industrial minerals other than diamonds, iron ore, bauxite and coal) would also have to be taken into account in a more comprehensive commodity analysis.

Another difficulty with the MEG survey is that worldwide exploration expenditures compiled by that survey are not comparable across all companies. In addition to reporting surface exploration expenditures, some companies report to MEG the search for extensions to orebodies in producing mines. Other companies include the costs of feasibility and engineering studies, but most do not. Because of these inconsistencies in what is included, it is difficult to assess the validity of comparisons of exploration expenditures by MEG across countries, or the validity of comparisons of MEG totals for Canada to totals from the federal-provincial survey (which clearly excludes the search for new ore in producing mines and deposits committed to production, as well as expenditures on feasibility studies and engineering studies at such properties).

Some MEG rankings compare total exploration budgets in individual countries such as Australia, Canada and the United States with those in vast geographical regions such as "Latin America," "Africa," "Pacific/Southeast Asia" and "Rest of World." Some of these comparisons are arbitrary and misleading. Latin America, for example, consists of more than 20 separate countries that jointly have an area, on two continents, that is more than double the area of each of Canada, the United States or Australia. Latin America has a mineral industry that has an annual value of non-petroleum mineral production that is almost double that of Canada and, therefore, it would not be unexpected for total Latin American exploration expenditures to be double those of Canada. Yet if all companies are taken into account, including companies with worldwide exploration expenditures lower than the US$2.9 million cut-off, this would probably not be the case.

The relative positions of countries in world exploration as reported by MEG have shifted from one year to the next, in part because of changing methodology, which led to new exploration expenditure cut-offs and the separation (in 1995) of "Africa" from "Rest of World". Until 1995, "Rest of World" had an area about ten times that of Canada, ten times that of the United Sates and about twelve times that of Australia.

The separation of "Africa" from "Rest of World" in 1995 resulted in a 30% decrease in the area of "Rest of World" and, consequently, a substantial decrease in exploration expenditures for "Rest of World." In its 1994 survey, MEG reported that "Rest of World" accounted for 15% of total world exploration expenditures of US$2.05 billion, that is, for US$308 million. In 1995, a redefined "Rest of World" accounted for only 6.7% of total world expenditures of US$2.69 billion, or US$180 million. This change helped to shift Canada's world position in terms of exploration activity (according to MEG) from fifth in 1994 to third in 1995. However, if Canada, the United States and Mexico, as well as the Central American portion of Latin America, had, for example, been combined by MEG into a region called North America, then North America would have consistently been first in terms of worldwide exploration activity for the past few decades. This analysis indicates some of the problems of comparing exploration expenditures for individual countries when expenditures are combined by geographical region.

7.3 CHANGING EXPLORATION EXPENDITURES - CANADA VERSUS THE WORLD

Exploration expenditures have been increasing annually since 1992, both in Canada and in the world as a

whole. Table 16 compares percentage increases in exploration expenditures or budgets in Canada (from the federal-provincial survey) to that for the remainder of the world (from MEG) since 1992. Although the percentage comparisons are not exact because of the changing annual budget cut-offs used in successive MEG surveys and because MEG does not include exploration budgets for all commodities, Canada would appear, from this table, to have increased its proportionate share of mineral exploration expenditures somewhat since 1992. However, MEG is probably not picking up an increasing portion of exploration expenditures by junior companies worldwide, both because of the increase in the survey's cut-off from US$1 million to US$2.9 million and because there has been a major increase in worldwide exploration expenditures by junior companies in the past three or four years.

With the apparent increase in exploration expenditures by junior companies worldwide, the proportion of total world exploration expenditures being directed at Canada (and also at Australia) may be diminishing as a percentage of total worldwide mineral exploration expenditures. But because exploration expenditures have been increasing rapidly, and because such expenditures in Canada, both in 1996 and in 1997, have been exceeded in only three previous years of 1987, 1988 and 1989 (possibly also in 1980 and 1981), there seems to be little reason to be concerned at this time, even if the proportion of worldwide exploration expenditures directed at Canada may have been declining somewhat. This is especially the case when one takes into account the fact that Canadian companies account for more exploration spending worldwide than do companies from any other country. Canadian companies can therefore be expected to benefit from mineral discoveries and new mines in other countries.

8. Globalization of the Mining Industry

8.1 INTRODUCTION

The ongoing globalization of the mining industry continues to bring increasing amounts of foreign exploration and development capital to a growing number of countries around the world. In 1996, the worldwide mineral exploration market for precious metals, base metals and diamonds grew by 30% to $6.3 billion (US$4.6 billion), up from $4.9 billion (US$3.5 billion) in 1995.

Canadian-based companies are at the forefront of this movement. They are active in over 100 countries and are predominant in certain parts of the world. This section provides an overview of Canadian exploration activity abroad. It also highlights the domestic and foreign components of the larger-company exploration market in Canada. The information in this review was current as at January 31, 1997.

8.1.1 Larger-Company Market

Much of what is known about global trends in mineral exploration for precious metals, base metals and diamonds is based on data with respect to the activities of the larger companies worldwide. These companies, defined here as those with annual exploration budgets greater than $4 million (US$3 million), control about three quarters of the global market for exploration. In 1996, there were 223 of these larger companies and, as a group, they were expected to spend $4.8 billion (US$3.5 billion) on exploration worldwide during that year (Figure 32).

8.2 CANADIAN EXPLORATION ACTIVITY ABROAD

8.2.1 Property Portfolio and Exploration Budgets

At the end of 1996, companies of all sizes listed on Canadian stock exchanges held interests in a portfolio of more than 8300 exploration or producing properties located in Canada or else-where around the world (Figure 33).

In 1996, the larger Canadian-based companies were expected to spend some $1.3 billion on mineral exploration both in Canada and elsewhere throughout the world (Figure 32). The budgets of these Canadian companies represent 28% of the exploration programs planned by all of the world's larger mining companies, up from 25% in 1995. Canadian companies currently hold the dominant share of the mineral exploration market worldwide.

Canadian companies have had considerable success in securing the financing required to undertake sizeable exploration programs both in Canada and abroad. As a result, the number of Canadian-based

companies that planned to spend more than $4 million on exploration around the world grew by 70% to 94 in 1996, up from only 55 in 1995. Many of these larger companies are junior companies, that is, they rely on the stock market rather than on retained earnings or debt to provide the capital required to conduct their exploration programs.

In 1996, the larger Canadian-based companies planned to spend $958 million on exploration outside of Canada. Over the past five years, the aggregate annual budgets (adjusted for inflation) of the larger Canadian-based companies for exploration abroad have increased at an average annual compound rate of 45%, up from $214 million in 1992.

The proportion of the aggregate budgets of the larger Canadian-based companies allocated to exploration outside Canada rose to over 70% in 1996. In 1992, 1993, 1994 and 1995, the proportions were 43%, 49%, 58% and 68% respectively.

At the end of 1996, companies of all sizes listed on Canadian stock exchanges held interests in some 3400 foreign mineral properties. Since the early 1990s, the average annual compound rate of growth in the acquisition of foreign mineral properties by these companies has been over 20%. During 1996, Canadian companies added 650 properties to their foreign mineral property portfolio.

Companies of all sizes listed on Canadian stock exchanges are active in more than 100 countries around the world. Apart from the United States, where Canadian companies have a substantial mining presence (**Figure 33**), two dozen other nations account for 80% of the balance of the mineral property portfolio held by Canadian companies abroad (**Figure 34**).

Most of the properties in which companies of all sizes listed on Canadian stock exchanges have interests are at the exploration stage. The ratio of foreign exploration properties to the total number of foreign exploration and producing properties held by such companies has increased steadily since the early 1990s. In late 1992, that ratio was 0.82 for Latin America and 0.74 for the rest of the world but, by late 1996, it had increased to 0.92 and 0.87 respectively. In comparison, the ratio of exploration properties to the total number of properties held in Canada has remained roughly constant at 0.95 over the past five years. Because exploration is more risky than production, it would appear that Canadian companies have assumed, over a relatively short period of time, increasing amounts of geological and country risk abroad.

A sample of some 300 foreign mineral property transactions in which junior companies based in Canada were involved over the two-year period July 1994 through June 1996 suggests that the current country strategy of this group of companies does not differ appreciably from that of senior companies.

8.2.2 Activity in the United States

In 1996, the larger-company exploration market in the United States was valued at some $470 million, or 10% of the $4.8 billion larger-company market worldwide (**Figure 32**). During that year, the larger Canadian-based companies planned to increase their exploration expenditures in the United States to $144 million. Adjusted for inflation, annual exploration budgets of the larger Canadian-based companies for the United States have grown at an average annual compound rate of about 14% since 1992. In 1996, Canadian-based companies held over 30% of the larger-company market for exploration in the United States. In 1992, the Canadian share was only 20%.

At the end of 1996, the United States accounted for more than one third of all properties held abroad by companies of all sizes listed on Canadian stock exchanges (**Figure 33**). The United States is likely to remain, for some time, the locus of the largest portfolio of mineral properties held by Canadian companies abroad. Between 1992 and 1995, the number of properties held in the United States by companies of all sizes listed on Canadian stock exchanges stood at about 1000 per year, but increased to over 1100 in 1996.

In 1996, there were more than 400 companies of all sizes listed on Canadian stock exchanges with projects in 34 of the 50 states in the United States. Most of their projects were located in the western states of Nevada, California, Arizona, Alaska, Idaho, Montana, Washington, Colorado and Utah. Nevada alone accounts for almost 400 properties, or more than one third of the Canadian portfolio in the United States.

Of all the Canadian-based companies, Barrick Gold Corporation and Placer Dome Inc. planned the largest 1996 exploration programs in the United States. Between them, these companies expected to spend over $67 million. Barrick is concentrating on the Goldstrike and other properties located on the Carlin gold

trend in Nevada, and Placer Dome is focussing on the South Pipeline gold project on the Battle Mountain-Eureka gold trend in Nevada and on the Donlin Creek gold project in Alaska.

8.2.3 Activity in Latin America and the Caribbean

In 1996, the larger-company exploration market in Latin America and the Caribbean was valued at some $1.3 billion, or 27% of the $4.8 billion larger-company market worldwide.

Latin America is the region of the globe with the most Canadian mineral exploration activity. The larger Canadian-based companies were expected to spend $485 million on exploration in Latin America and the Caribbean during 1996, a substantial increase over the $393 million they had budgeted for 1995 (**Figure 32**).

Adjusted for inflation, Canadian exploration budgets for Latin America grew at an average annual compound rate of over 50% between 1992 and 1996. In 1996, Canadian-based companies controlled 37% of the larger-company market in Latin America, the largest share, by far, in the region. In 1992, the Canadian share of that market was 27%.

During 1996, the number of properties held in Latin America by companies of all sizes listed on Canadian stock exchanges surpassed, for the first time, the number held in the United States (**Figure 33**). These companies held more than 850 properties in South America, 280 in Mexico, and 140 in Central America and the Caribbean. They held about 140 in each of Chile, Peru and Venezuela, more than 120 in Argentina, and more than 50 in each of Brazil, Bolivia, Ecuador and Guyana.

At the end of 1996, there were at least 260 Canadian mining companies active in South America, 120 in Mexico, and 90 in Central America and the Caribbean.

In 1996, Canadian-based companies planned the largest exploration programs for several countries of Latin America and the Caribbean: Barrick in Chile, Bolivar Goldfields Ltd. in Colombia, Placer Dome in Costa Rica, KWG Resources Inc. in Cuba and Haiti, Eldorado Gold Corporation in the Dominican Republic, Greenstone Resources Ltd. in Honduras, Triton Mining Corp. in Nicaragua, Teck Corporation in Panama, Cambior Inc. in Surinam, and Rea Gold Corporation in Uruguay.

8.2.3.1 Mexico

In 1996, the larger Canadian-based companies planned to spend more than $70 million on exploration in Mexico, equivalent to about 40% of the market there. Mexico remains, by far, the Latin American country where Canadian companies are the most active. During 1994, there was a significant increase in the average size of mineral property portfolios held by Canadian companies in Mexico and, at the end of that year, companies of all sizes listed on Canadian stock exchanges had projects in at least half of Mexico's 31 states.

For 1996, Farallon Resources Ltd. and Teck planned the largest Canadian exploration programs in Mexico. Between them, these companies were expected to spend more than $25 million in that country. Farallon planned to spend $15 million on the Campo Morado gold-silver property located in the state of Guerrero, and Teck planned to spend $15 million on a dozen properties in Mexico with a substantial portion allocated to the Nukay gold project, also in the state of Guerrero.

8.2.4 Activity in Africa

In 1996, the larger-company exploration market in Africa was valued at some $570 million, or 12% of the $4.8 billion larger-company market worldwide.

The larger Canadian-based companies planned to spend over $112 million on exploration in Africa during 1996; this amount is double what they had budgeted for 1995, and is equivalent to about 20% of the larger-company market on that continent.

Between 1992 and 1996, companies of all sizes listed on Canadian stock exchanges acquired mineral properties in Africa at an average annual compound rate of 75%. As a consequence, at the end of 1996, more than 170 of these companies held interests in over 440 mining properties located in 27 countries in

Africa. They held almost 100 properties in Ghana alone, almost 70 in Tanzania, 40 or more in each of Zimbabwe, South Africa and Burkina Faso, and 20 or more in each of Botswana and Mali.

During 1996, 15 Canadian-based companies planned mineral exploration programs valued at over $4 million each, mainly in West Africa, Tanzania or Zimbabwe. Although gold is the primary Canadian target in Africa, there is nonetheless a considerable variety in the mineral commodities sought there by Canadian companies. Some of the commodities of interest to Canadians on that continent are not currently produced or are not widely sought in Canada.

8.2.5 Activity in Southeast Asia and China

In 1996, the larger-company exploration market in the broad area of Southeast Asia and China was valued at over $400 million, or 8% of the $4.8 billion larger-company market worldwide. The larger Canadian-based companies planned to spend at least $120 million on exploration in that region during 1996, equivalent to about 30% of the market there.

At the end of 1996, there were 150 companies of all sizes listed on Canadian stock exchanges active in eight countries of Southeast Asia as well as in China. These companies held interests in almost 270 properties in that region, a dramatic increase over the course of one year.

Indonesia has experienced an exploration boom. From Canada alone, there were about 100 companies of all sizes listed on Canadian stock exchanges active in Indonesia at the end of 1996, up from only a dozen one year earlier. At the end of 1996, these companies held interests in 140 properties, up from less than 20 one year earlier. The larger Canadian-based companies were expected to spend about $90 million in Indonesia during 1996.

The Philippines continue to attract Canadian mining companies. At the end of 1996, there were over 20 companies of all sizes listed on Canadian stock exchanges with interests in over 50 mineral properties in that country. About one third of their projects involved gold, one third involved copper-gold, and the rest involved a variety of other metals including chromium, cobalt, copper, nickel, molybdenum and zinc.

Over the past three years, there has been growing interest on the part of Canadian mining companies in mainland China. In late 1996, there were more than 20 companies of all sizes listed on Canadian stock exchanges with interests in close to 40 mineral properties in that country. About half the projects in China involved gold. The other half involved copper-lead-zinc and a variety of other targets including diamonds, rare earths and zeolites.

8.2.6 Activity in the Former Soviet Union

In 1996, the larger-company exploration market in the former Soviet Union (FSU) was valued at over $100 million, or 2% of the $4.8 billion larger-company market worldwide. The larger Canadian-based companies were expected to spend at least $45 million on exploration in the FSU during 1996, equivalent to about 40% of the market in that region.

Over the past few years, there has been growing Canadian interest in participating in mineral opportunities in the FSU. At the end of 1996, there were almost 40 companies of all sizes listed on Canadian stock exchanges with interests in 65 mineral properties in seven countries of the FSU. The current strategy of most of these companies appears to be to target a single country.

Russia is by far the area of the FSU where Canadian companies are the most active. During 1996, the number of properties held by companies of all sizes listed on Canadian stock exchanges increased threefold to 30. At the end of 1996, there were at least 13 Canadian companies active in Russia. Gold and, to a lesser extent, diamonds are the main exploration targets of Canadian companies in that country.

In early 1996, Nelson Gold Corporation Ltd., which is listed in Canada but based in the United Kingdom, started production at its Jilau (Zaravshan project) open-pit gold mine in Tajikistan. In January 1997, Cameco Corporation began production at its one-third-owned 500 000-oz/y open-pit Kumtor gold mine in Kyrgyzstan. Canadian companies also have mineral property interests in Kazakstan, the Ukraine and Uzbekistan.

8.2.7 Activity in Australia

In 1996, the larger-company market for exploration in Australia was valued at some $900 million, or 19% of the $4.8 billion larger-company market worldwide (Figure 32). The larger Canadian-based companies planned to spend at least $7 million on exploration in that country during 1996. Placer Pacific Limited, which is Australian-based but more than 75% controlled by Canadian-based Placer Dome, intended to spend about $13 million in Australia during 1996. Other Canadian companies that planned exploration programs in Australia include William Resources Inc., Noranda Inc., and Tri-Origin Exploration Ltd.

Since 1992, the larger Canadian-based companies have held no more than about 1% of the larger-company market for exploration in Australia. As well, companies of all sizes listed on Canadian stock exchanges probably have held, on average, no more than 50 properties per year in that country.

8.3 CANADIAN MARKET SEGMENT

8.3.1 Total Exploration Market in Canada

In 1996, the total exploration market in Canada was valued at about $875 million.

The value of the total exploration market in Canada is based on comprehensive Canadian government statistics that cover the activities of both senior and junior companies. Canada is one of the few countries for which comprehensive exploration statistics are available. For the world as a whole, statistics are available only for the group of larger companies.

8.3.2 Advanced Projects in Canada

In late 1996, there were more than 4900 active mineral properties in Canada, spanning the various phases of mineral resource development from conceptualization of mineral exploration programs through production. The number of mineral properties active in Canada has remained fairly constant over the past five years (Figure 33).

Since 1994, there has been a significant increase in Canada in the number of mineral deposits undergoing geological, engineering, environmental and economic studies aimed at supporting a possible production decision (Figure 35). As a result, in early 1997, there were at least 173 projects undergoing mineral deposit appraisal, which represents a 20% increase from 144 such deposits in early 1996. The deposits currently being appraised contain one or more of barite, bismuth, calcium carbonate, cobalt, copper, chromium, fluorine, gallium, garnet, gold, indium, iron, lead, lithium, magnesium, molybdenum, nickel, palladium, phosphorus, platinum, silver, titanium, tungsten, vanadium, zinc or zircon. Of the 173 mineral deposits undergoing appraisal in Canada, 99, or 60%, are precious-metal deposits and 74, or 40%, are base-metal or other types of deposits.

8.3.3 Larger-Company Market in Canada

In 1996, the larger-company market for exploration in Canada was valued at over $630 million, or 13% of the $4.8 billion larger-company market worldwide (Figure 32). Canada's share of the larger-company global budgets for exploration has remained in the 12-13% range over the last three years. In 1996, the larger-company market in Canada represented about 70% of the total market for mineral exploration in Canada. The aggregate exploration budgets of the world's larger companies for Canada have increased most years since 1992, but they underwent especially strong growth during 1996.

The larger Canadian-based companies were expected to spend almost $390 million in Canada during 1996, up from $296 million in 1995. In 1996, these companies controlled slightly more than 60% of the larger-company market for mineral exploration in Canada, which is by far the dominant share. The situation is identical in the United States and Australia where American-and Australian-based companies control the largest share of their respective domestic larger-company markets for mineral exploration. In 1992, Canadian-based companies controlled 80% of the larger-company exploration market in Canada. With increasing globalization, the market share controlled by the larger domestic firms has also declined in the United States and Latin America. In Australia, on the other hand, Australian companies still control 80% of their domestic market (Figure 32).

Globalization of the mining industry is not only providing benefits to developing countries. Over the last five years, much of the increase in exploration expenditures of the larger companies operating in Canada has come from foreign investment by Australian-based, and European-based companies. Large foreign-based multinational companies were expected to spend over $240 million in Canada during 1996, an increase of more than 40% over their 1995 budgets. The budgets of the larger foreign multinational companies represent 38% of the total budgeted for 1996 for Canada by all of the larger companies, including Canadian companies. Adjusted for inflation, foreign multinationals' exploration budgets for Canada in 1992 only totalled about $70 million.

Large foreign-based multinational companies active in Canada include BHP Minerals Pty Ltd., WMC Limited and the Ashton Group, all based in Australia; Echo Bay Mines Ltd., Royal Oak Mines Inc., the Homestake Group, Battle Mountain Gold Company, Phelps Dodge Corporation, Cyprus Amax Minerals Company, Santa Fe Pacific Gold Corp., FMC Gold Company, Newmont Gold Company, and Pegasus Gold Inc., all based in the United States; the RTZ-CRA Group, the Minorco Group, and Outokumpu Metals and Resources Oy, all based in Europe; the Gencor Group and the De Beers Group based in Africa; and Korea Zinc.

8.4 SUMMARY AND CONCLUSIONS

Mining offers the prospect of diversifying and strengthening the economies of many nations. The development of a mining industry accelerates the revision of laws and regulations aimed at protecting foreign investment. The effectiveness of such initiatives is most noticeable in the growth of exploration activity that has taken place in developing countries around the world. There is every indication that, for the foreseeable future, the legislative process that is currently increasing the efficiency of mineral resource development worldwide will continue, if not accelerate.

The mining industry is becoming evermore globalized, and growth in mining activity is expected to continue in many countries of Latin America, Africa, Southeast Asia and the former Soviet Union. In many countries in these regions, there is enormous geological potential, but modern exploration techniques have yet to be widely used. The specific loci of future growth in mineral exploration and development will be influenced significantly by industry perceptions of country risks and rewards.

Canadian-based mining companies now control almost 30% of the world's larger-company market for precious-metal, base-metal and diamond exploration, and they hold the dominant share of that market in both Canada and Latin America. They have also diversified their mineral project portfolios to more than 100 foreign countries.

Canadian expertise at raising risk capital from investors in Canada, the United States, Europe, Asia and elsewhere has facilitated the penetration by Canadian companies of the mining market around the world. As a consequence of the globalization of the Canadian mining industry, there exists unprecedented opportunity for Canadian suppliers of goods and services for mineral exploration, development or production to expand their exports significantly.

The world's foreign multinational companies are diversifying their mineral property portfolios not only into developing countries, but also into developed countries, including Canada. During the last five years, Canada has attracted increasing amounts of exploration investment from some of the larger foreign-based companies, which has resulted in a substantial increase in the total amount of exploration activity in this country.

For the foreseeable future, Canadian companies will continue to be a driving force for exploration, development and mining in both Canada and abroad. Canadian mining companies, and Canadian suppliers of goods, services and risk capital, can be expected to make further gains in foreign mining markets.

APPENDIX A: Federal-Provincial Survey of Mining and Exploration Companies

SURVEY PROCESS

The federal-provincial survey of mining and exploration companies is conducted twice a year. It provided information, in early 1997, about individual company estimates for their 1996 total exploration expenditures and their 1997 spending intentions. In early 1997, a more detailed actual survey of 1996 exploration activity was distributed and is currently being compiled. The preliminary survey was conducted during the last quarter of 1996 and January 1997, while the actual survey will be conducted throughout 1997.

In addition to finalizing preliminary estimates, the actual survey provides other project-based information, including specific commodities explored for, type of field work undertaken, related overhead expenditures, type of company involved, joint-venture partners, and other details. Commodity-specific information on exploration expenditures for diamonds for 1996 and 1997 was estimated by NRCan. These estimates are based on knowledge of the industry and on previously reported information that has been confirmed with the company involved or with provincial/territorial counterparts.

The surveys are a full census of all the companies involved in mineral exploration in Canada. Generally, only about 2% of questionnaires are not completed. When this happens, estimates to replace missing values are provided by the province or territory concerned. However, this 2% usually represents small or inactive operations; therefore, virtually all exploration expenditures are covered by the survey.

Surveys are conducted through a joint effort between the federal government and participating provinces. Statistics Canada coordinates the survey sent to mineral-producing establishments (246 questionnaires in October 1996); NRCan coordinates the survey for the non-mineral producing firms (2049 questionnaires, also in October 1996). Altogether, 1644 companies and prospectors were surveyed in late 1996 and early 1997.

It should be noted that a company may receive more than one questionnaire depending on the number of provinces in which it has activities. To avoid duplicate reporting, joint-venture partners who are not project operators do not report intended expenditures on exploration. Companies are asked to report exploration expenditures for their fiscal year that ends between April 1 and March 31 of the following year for each year surveyed.

SURVEY DETAILS

The time lag between the 1997 forecast survey conducted in late 1996 and the final 1997 survey to be conducted in 1998 may give rise to discrepancies between the two surveys.

Spending intentions may often be modified by events that can limit the availability of funds, such as stock market conditions, changing metal prices, general economic factors or company-specific factors, and the impact of new discoveries. As shown in Table 17, the results of this survey cannot be interpreted as being an accurate reflection of the exploration that will ultimately be performed in 1997.

Table 17 shows intentions, as well as preliminary and actual expenditures, when available, for mine-site and general exploration for the years 1985-97. This table demonstrates that, for the periods 1985-88 and 1993-95, total final expenditures (actual basis) exceeded intentions and preliminary results reported earlier for the same period. For the period 1989-92, this pattern was reversed. A possible explanation for the period 1985-88 could be that flow-through share exploration funding became more available than companies had originally anticipated but, starting in 1989, there was an unexpected decline in the availability of those flow-through share funds. Similarly, for the period 1993-95, general funding was probably more readily available than originally expected as a result of the growing interest generated by discoveries of diamonds in Canada's north and of nickel-copper-cobalt at Voisey's Bay in Labrador.

DEFINITIONS

The questionnaires ask for both general (off-property) and mine-site (on-property) exploration expenditures. Those numbers are combined for most of the analysis. General exploration includes exploration activity on properties neither in production nor committed to production, while mine-site exploration measures activity on additional deposits on properties either in production or committed to production. Field work and total expenditures, including overhead costs, are both available from the actual survey. The preliminary survey includes only total exploration with overhead costs. Overhead costs include mineral lease rental and other land costs, administration and general overhead costs in the field,

and exploration-related head office expenses in the province/territory for which operations are being reported.

CLASSIFICATION OF COMPANIES

Some of the analysis within this report is carried out according to the six company types defined below. Other sections only distinguish between junior and senior companies. The senior category includes categories 1 to 4 and 6. As stated above, for joint ventures, total project expenditures are reported by the project operator. As discussed in Section 6.6, junior participation (funding) can be found in exploration projects managed by senior companies and, to a lesser extent, senior participation can be found in projects managed by junior companies. Nevertheless, data analysis has been consistent over the years and a clear trend can be noted.

Companies exploring in Canada are classified into six groups, as follows:

1. Producers: Companies with a producing mine or part ownership in a producing mine in Canada, and companies that own more than 50% of the shares of a producing mining company. Also includes oil companies or foreign companies with a producing Canadian mine.
2. Affiliates of producing mining companies: Wholly owned or majority-owned incorporated subsidiaries of producers.
3. Oil companies: Oil companies, both domestic and foreign, with non-petroleum exploration projects in Canada. Oil companies with producing mines are included with producers.
4. Foreign companies: This group excludes foreign-owned oil companies and foreign-owned companies with a producing mine in Canada.
5. Junior companies and prospectors: This group excludes all of the other categories.
6. Other companies: Canadian-owned companies engaged in mineral exploration, including forestry, construction and consulting firms, and government-owned mining companies that do not own a producing mine. This category also includes Canadian-owned companies with operating mines only in countries other than Canada.

A company is classified into the first of these groups into which it fits. For example, exploration statistics reported by an oil or foreign company with a producing Canadian mine would be included in Category 1 (producers), rather than in Category 3 (oil companies) or Category 4 (foreign companies). Exploration by foreign-owned oil companies would appear in Category 3 (oil companies), and not in Category 4 (foreign companies).

APPENDIX B: A Listing of the Two Main Exploration Properties or Groups of Properties by Province or Territory in 1996 and 1997

Click to view the following tables : Table 18 / Table 19

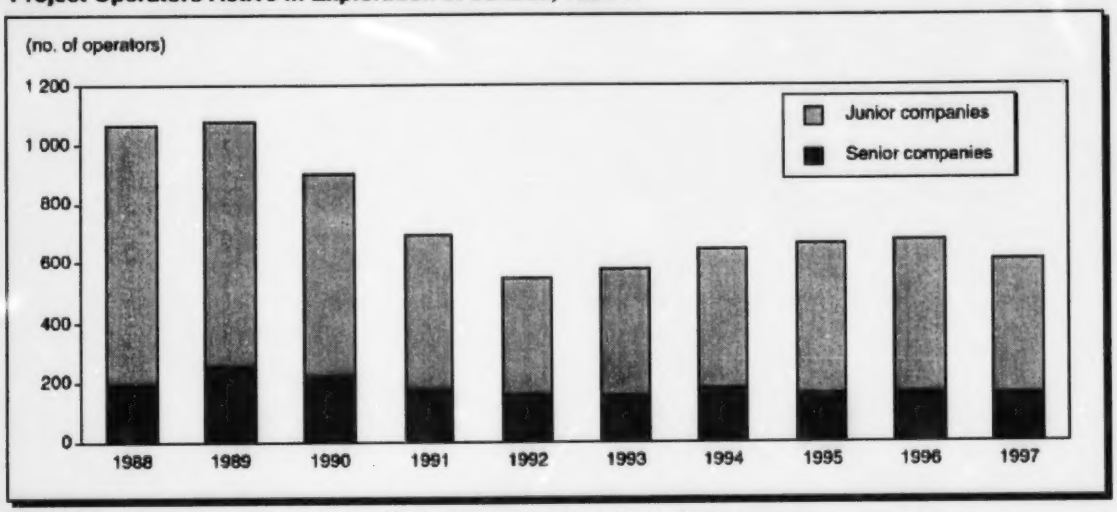
Investment Promotion Home Page:

Economic and Financial Analysis Branch,
Minerals and Metals Sector
Natural Resources Canada

03537

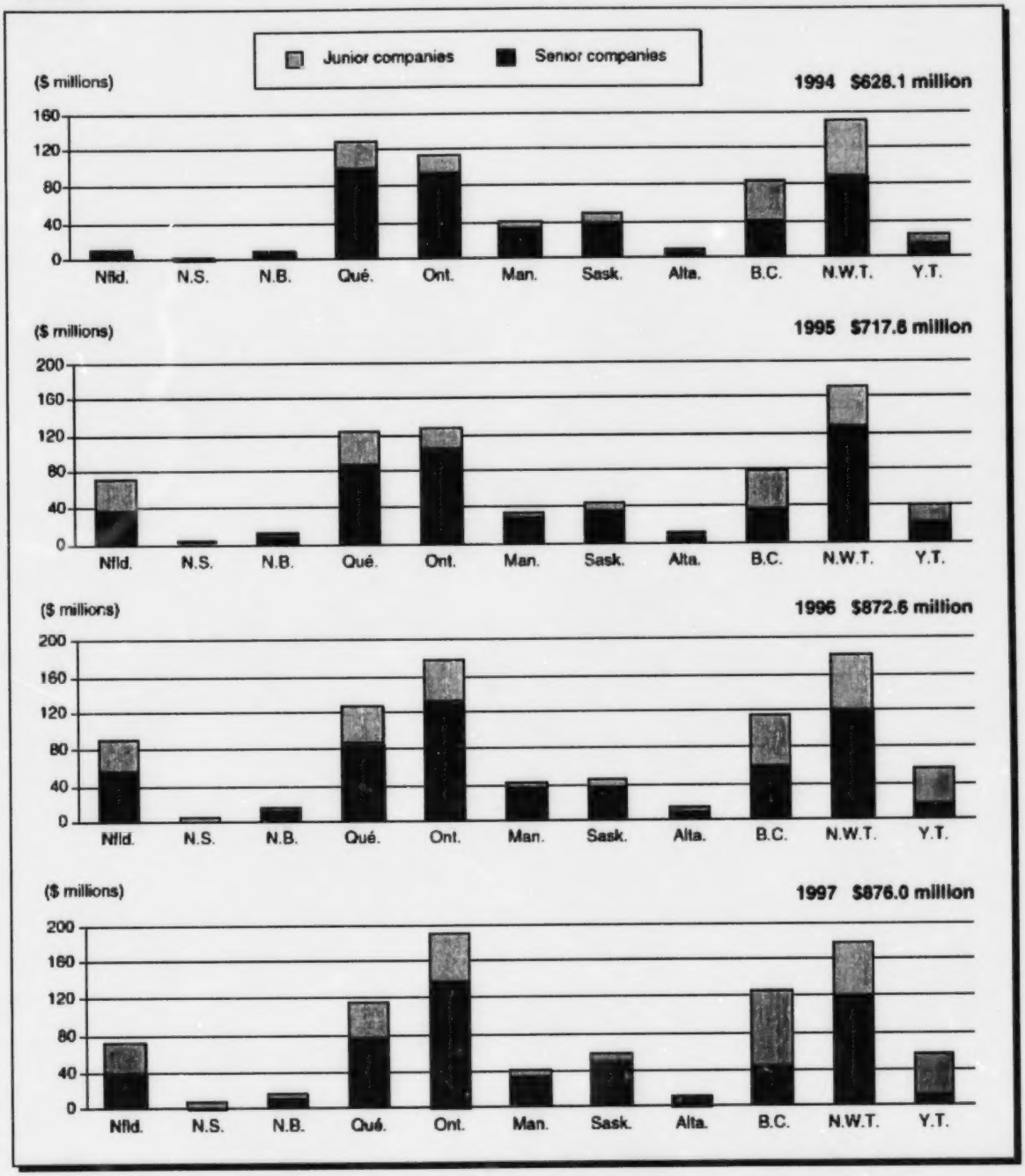
Canada

Figure 1
Project Operators Active in Exploration in Canada, 1988-97



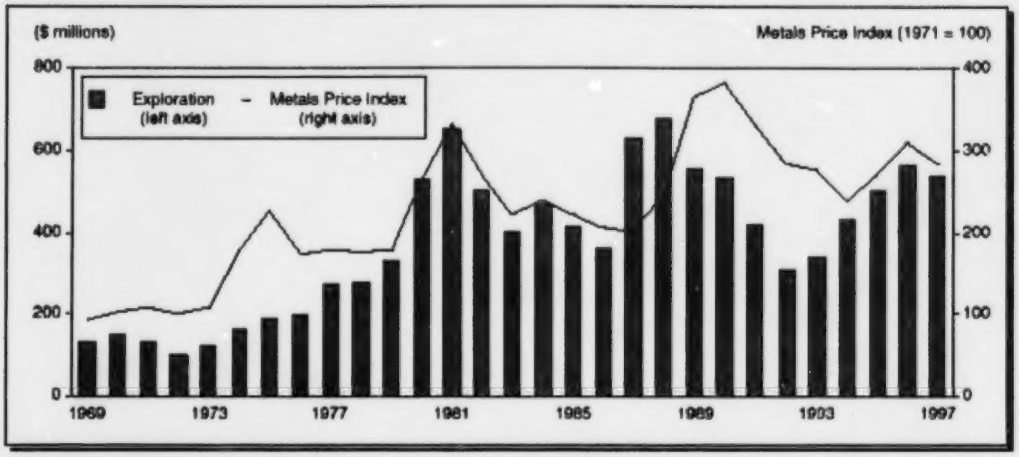
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: Data exclude prospectors. 1996 data are preliminary; 1997 data are based on company spending intentions.

Figure 2
Exploration Expenditures in Canada by Junior and Senior Companies, by Province and Territory, 1994-97



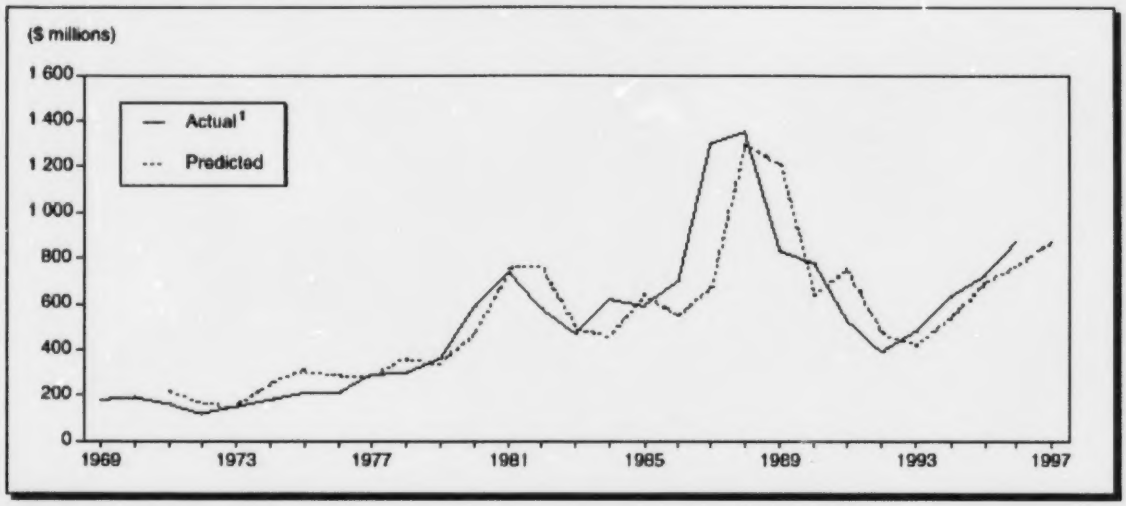
Sources: Natural Resources Canada and Statistics Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: 1996 data are preliminary estimates; 1997 data are company spending intentions as compiled in January 1997. Overhead expenditures are included.

Figure 3
Exploration Expenditures in Canada by Senior Companies, and the Metals Price Index Lagged One Year, 1969-97



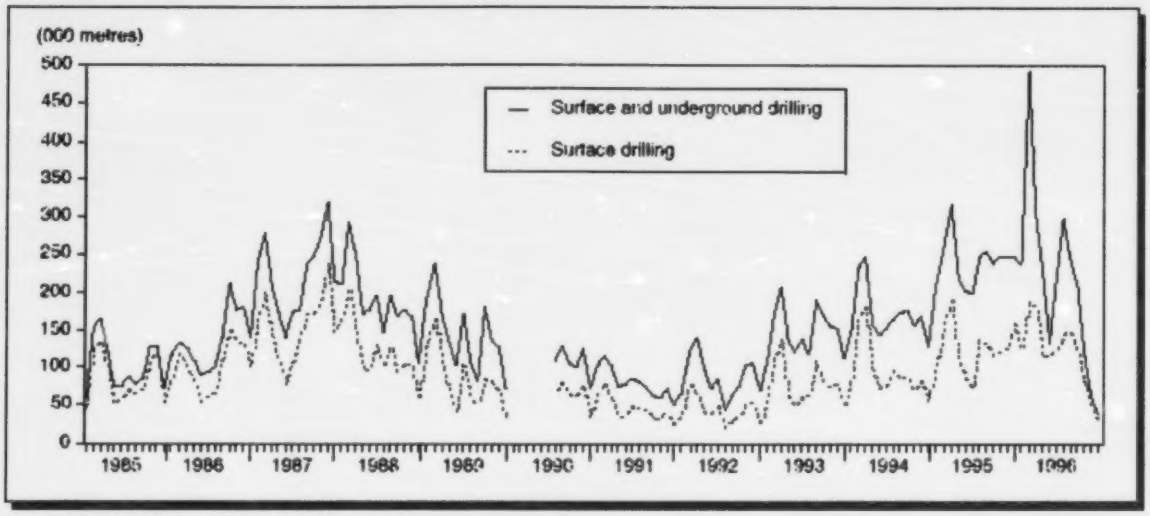
Source: Natural Resources Canada and Statistics Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: 1996 exploration data are preliminary; 1997 data are company spending intentions as compiled in January 1997. Overhead expenditures are included. "Lagged" means that the 1968 Metals Price Index is compared to 1969 exploration expenditures, and so on.

Figure 4
Actual and Predicted Exploration Expenditures in Canada, 1969-97



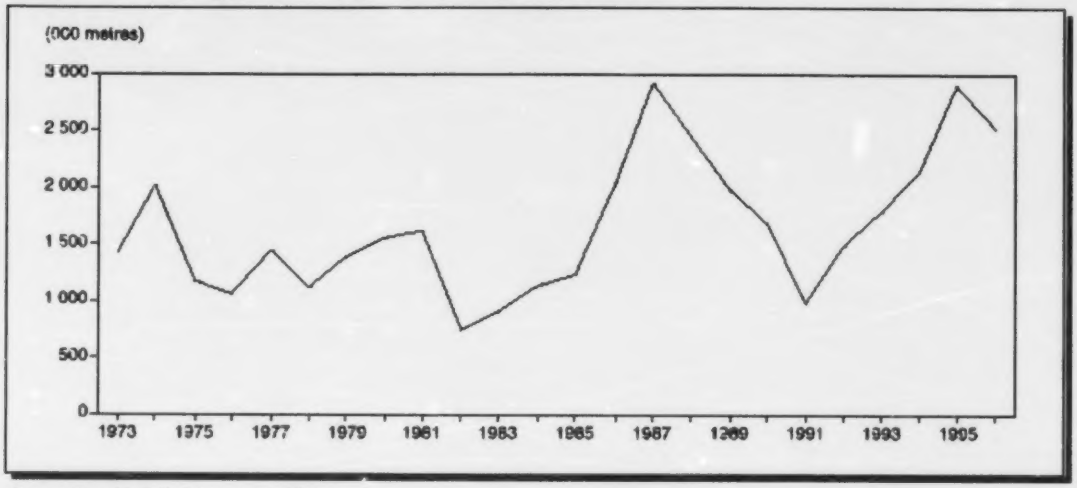
Source: Natural Resources Canada.
[1] For 1996, preliminary expenditures are shown because actual expenditures were not available.

Figure 5
Surface and Underground Drilling in Canada, by Month, January 1985 to December 1996



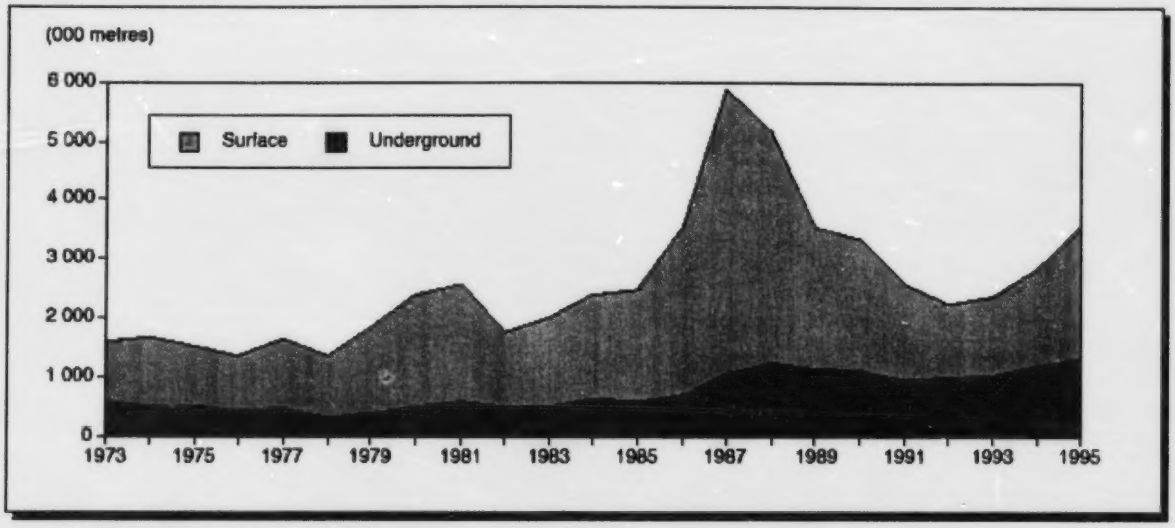
Source: Canadian Drilling Association (CDA).
Notes: CDA data are incomplete because not all member companies report their drilling. Monthly data were *not* available for the period January to June 1990 because final CDA statistics for this period were released only as a six-month total. Data for 1996 are even more incomplete because the survey is not yet final.

Figure 7
Surface and Underground Drilling in Canada, by Year, 1973-96



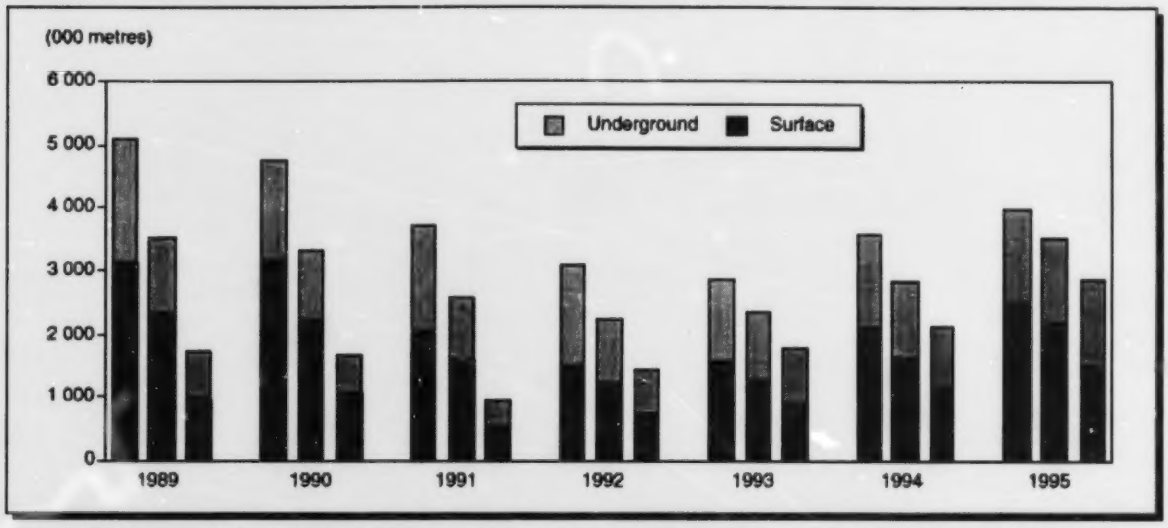
Source: Canadian Drilling Association (CDA).
Notes: CDA data are incomplete because not all member companies report their drilling. Data for 1996 are even more incomplete because the survey is not yet final.

Figure 8
Surface and Underground Drilling in Canada, Contract Diamond Drilling Operations, 1973-95



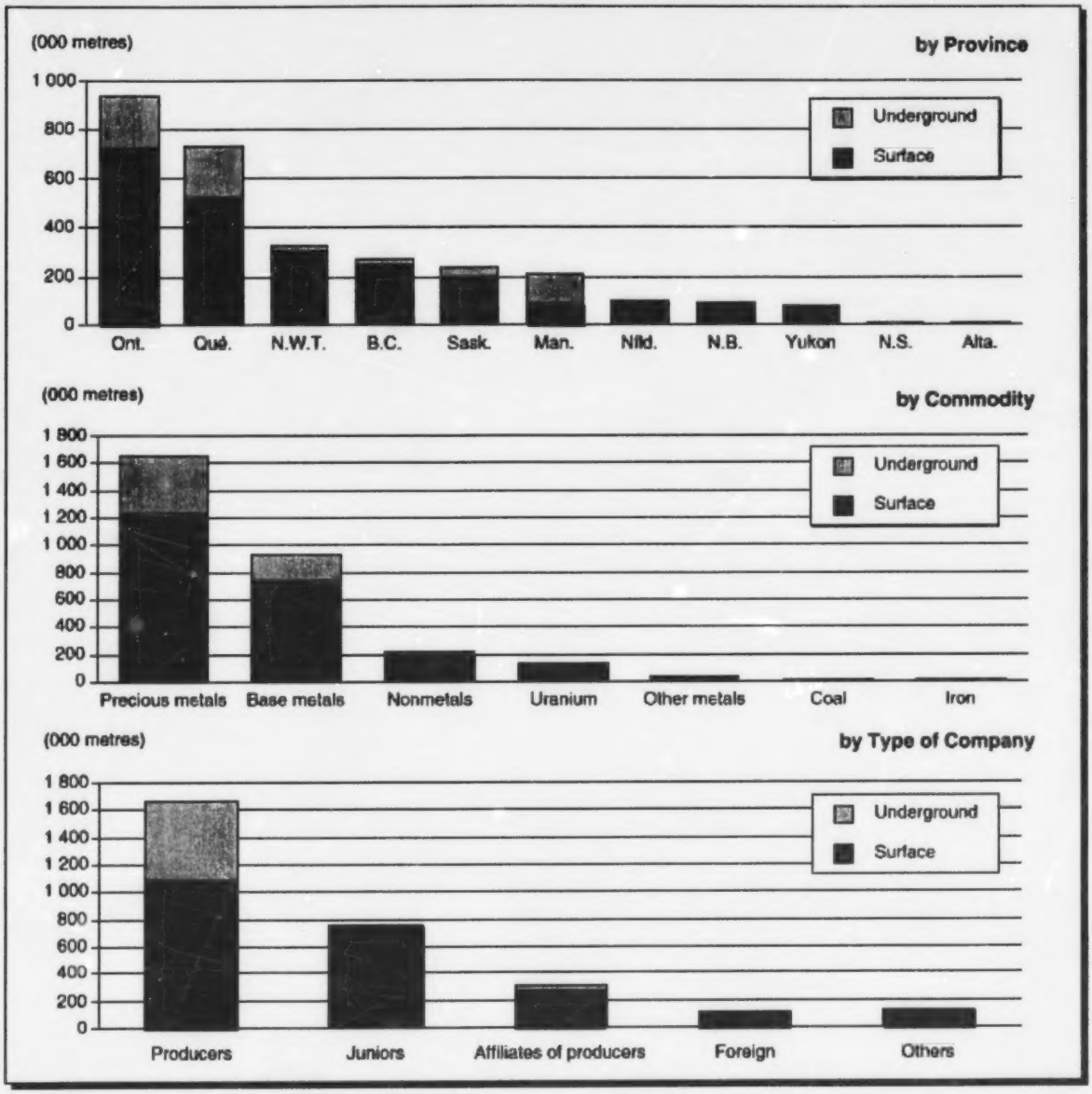
Source: Statistics Canada, catalogue no. 26-201.
Note: Data refer to SIC 0921; 1995 is the latest year for which data are available.

Figure 9
Comparison of Three Surveys of Canadian Diamond Drilling, 1989-95



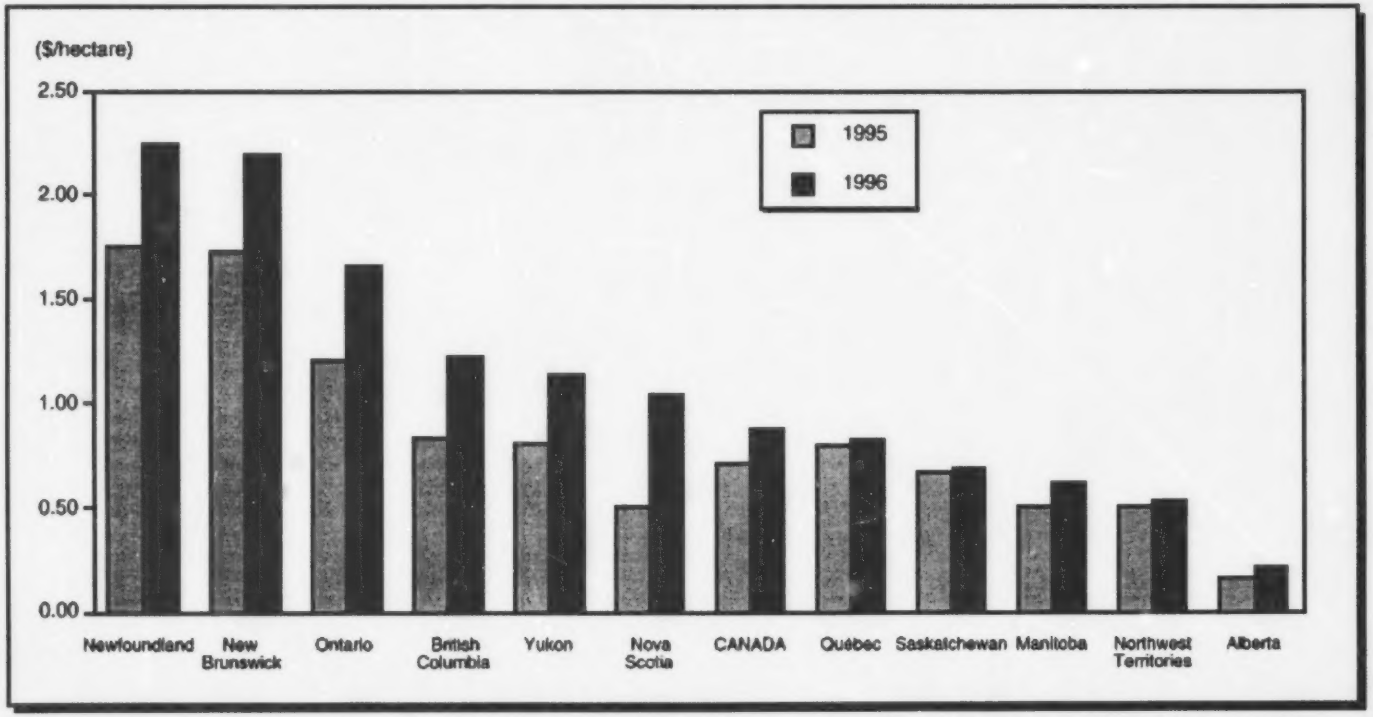
Sources: Federal-provincial survey of mining and exploration companies (left bar in each cluster); contract diamond drilling survey (middle bar in each cluster); Canadian Drilling Association (right bar in each cluster).
Note: All data include mine-site development drilling.

Figure 10
Surface and Underground Exploration Diamond Drilling in Canada, 1995



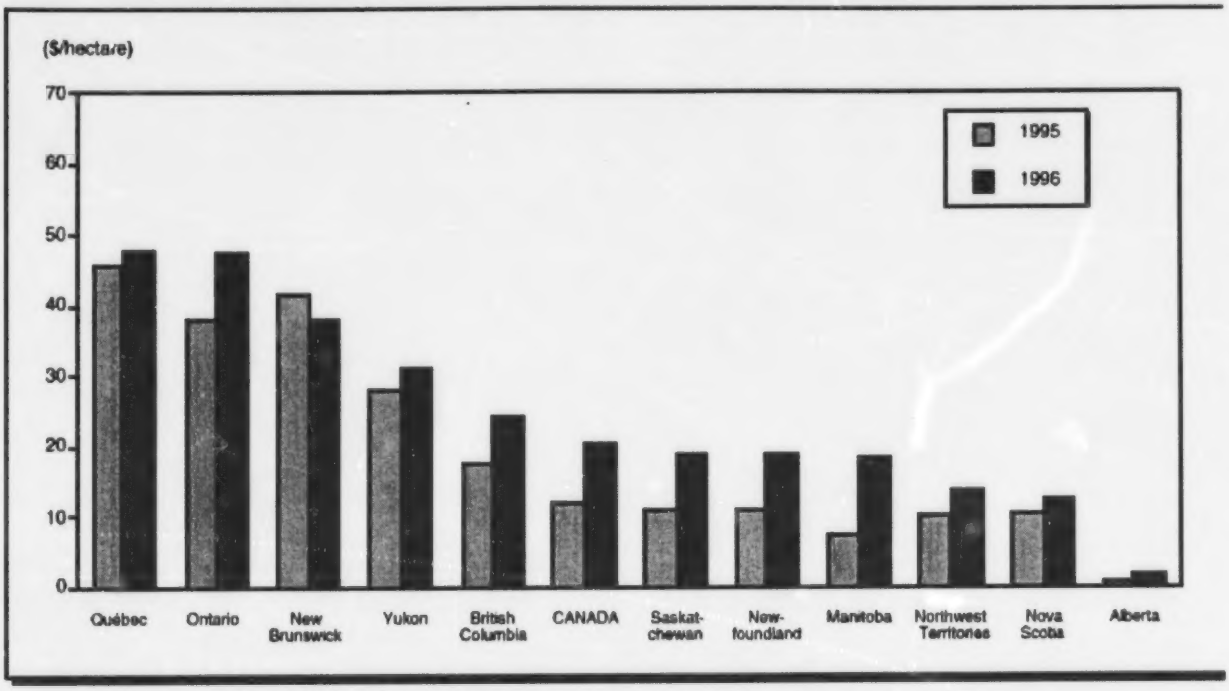
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Note: Exploration includes general plus mine-site exploration, which includes only the search for new mines.

Figure 11
Canada, Total Exploration Expenditures Per Hectare, by Province and Territory, 1995 and 1996



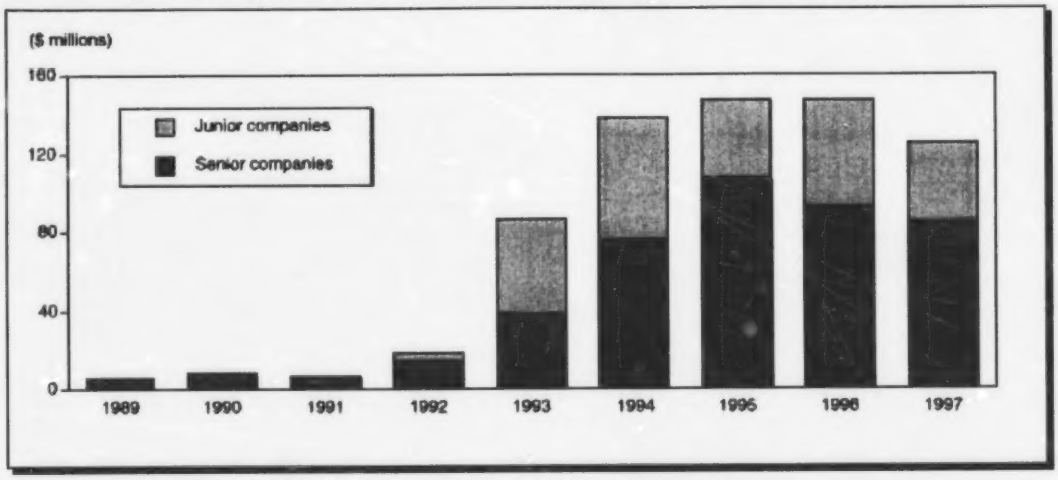
Source: Natural Resources Canada, based on the National Atlas Information Service and the federal-provincial survey of mining and exploration companies.

Figure 12
Canada, General Exploration Expenditures Per Hectare of Claims in Good Standing, by Province and Territory, 1995 and 1996



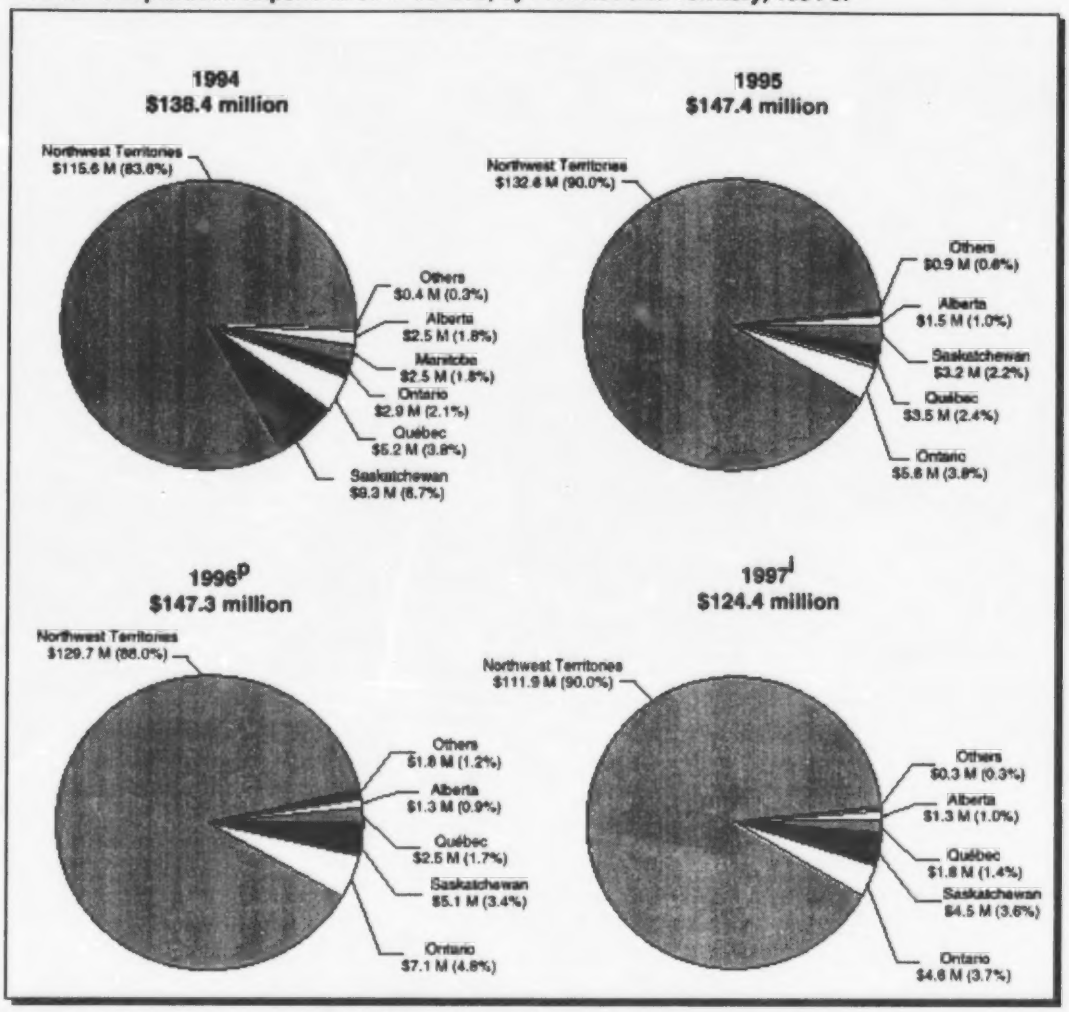
Sources: Federal-provincial survey of mining and exploration companies; provincial/territorial mining recorders offices.
Notes: General, or off-property, exploration excludes mine-site exploration. "Claims in good standing" excludes mining leases.

Figure 13
Diamond Exploration Expenditures in Canada by Junior and Senior Project Operators, 1989-97



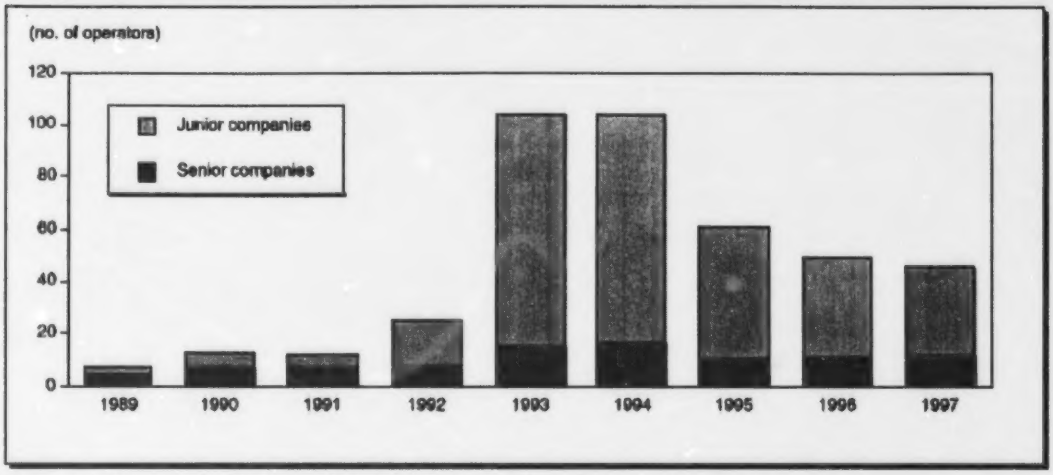
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Note: 1996 data are preliminary estimates; 1997 data are company spending intentions as compiled in January 1997.

Figure 14
Diamond Exploration Expenditures in Canada, by Province and Territory, 1994-97



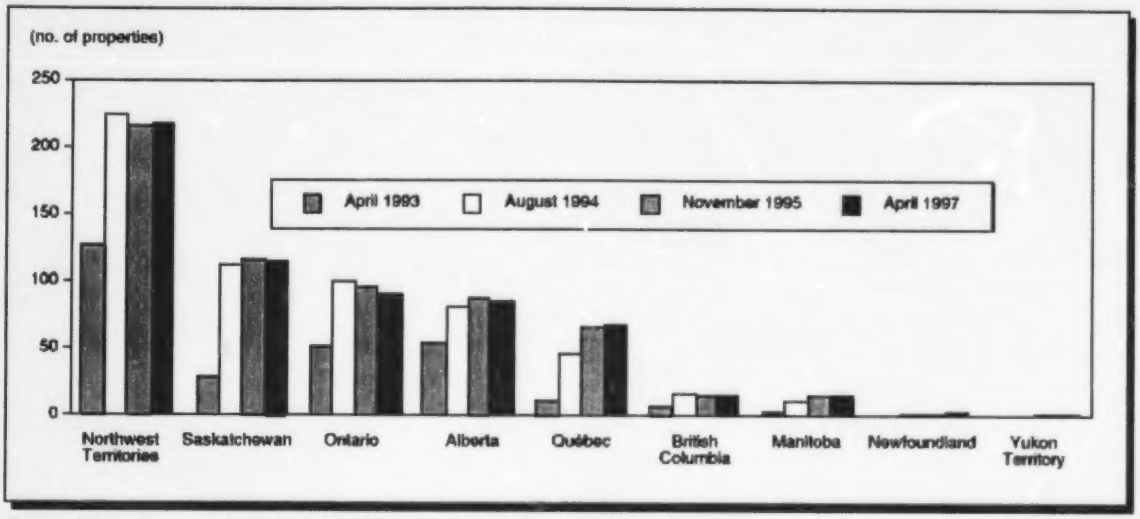
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
[I] Company spending intentions as compiled in January 1997; [P] Preliminary estimate.
Note: "Others" includes Newfoundland and either British Columbia or Manitoba.

Figure 15
Junior and Senior Project Operators Active in Diamond Exploration in Canada, 1989-97



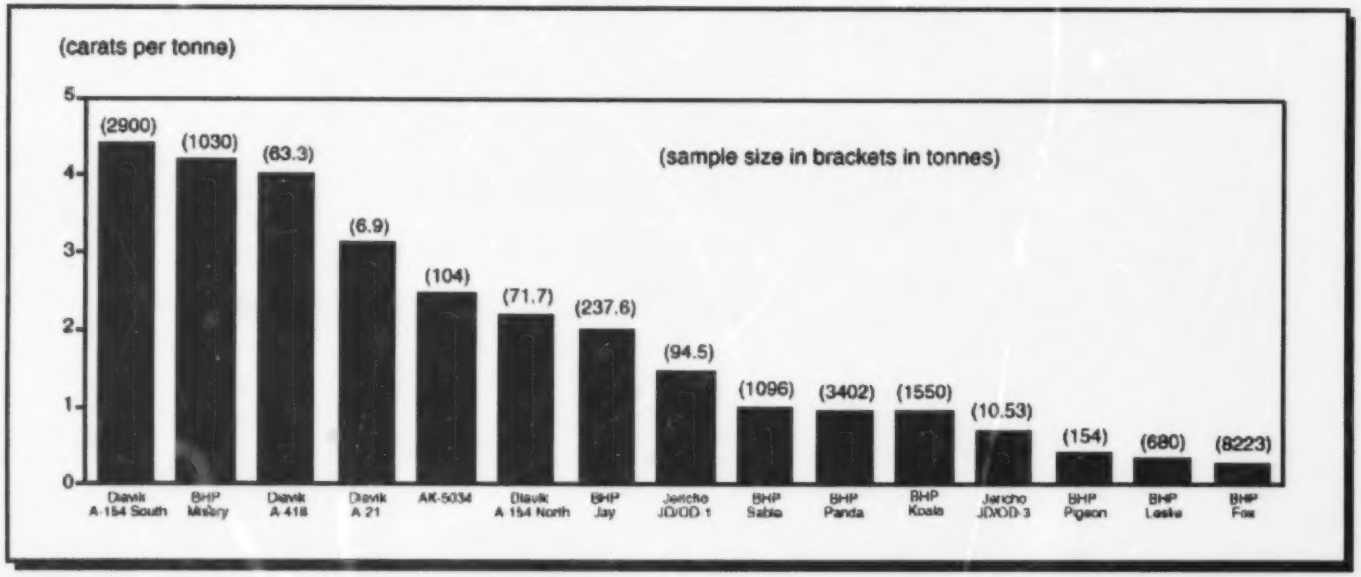
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Note: 1996 data are preliminary; 1997 data are based on company spending intentions.

Figure 16
Exploration for Diamonds in Canada
Distribution of Properties by Province and Territory



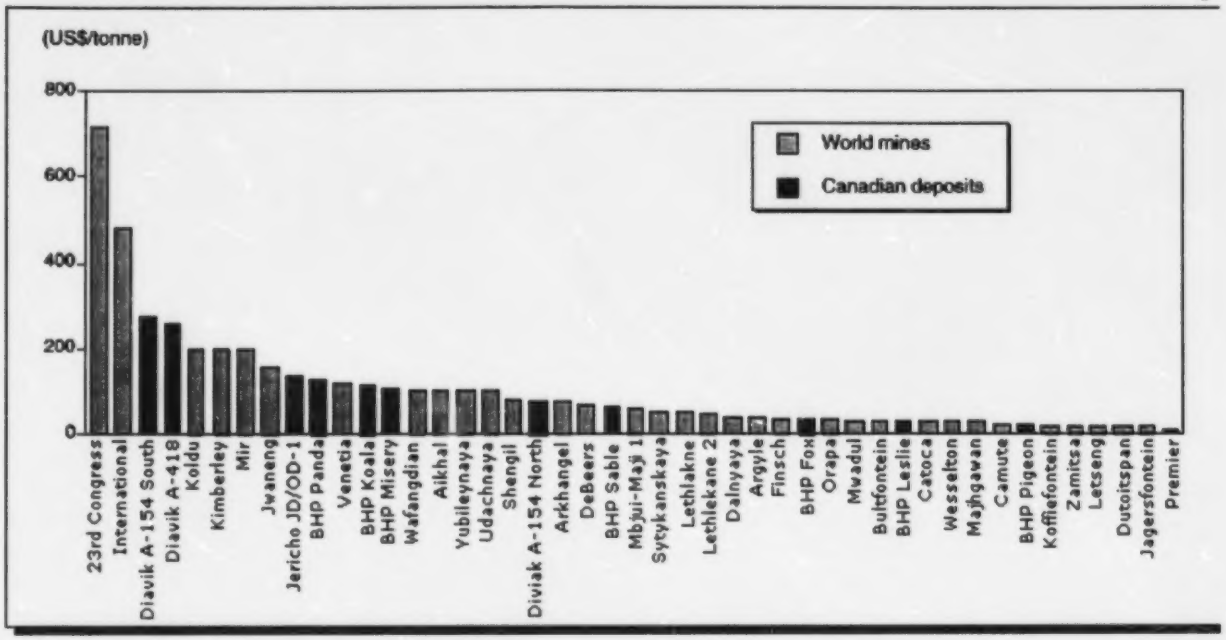
Source: Natural Resources Canada, based on MIN-MET CANADA database, and used under licence.

Figure 17
Grades of Selected Canadian Diamond Deposits



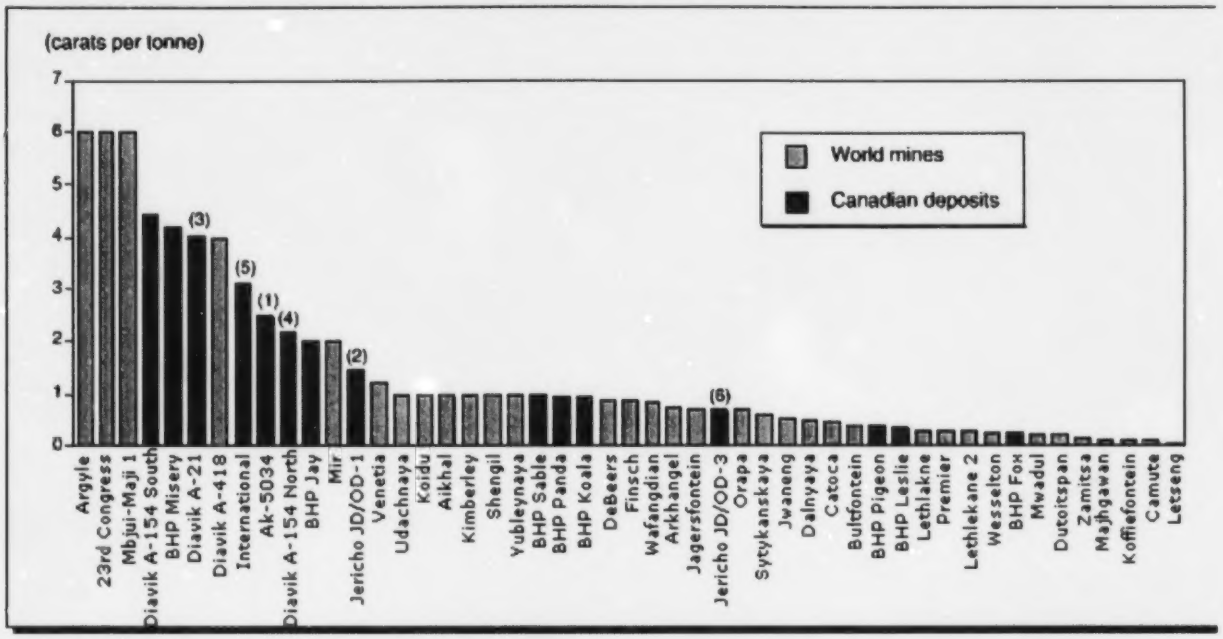
Source: Natural Resources Canada, based on published data.

Figure 18
Recoverable Diamond Values from World Diamond Mines and Canadian Diamond Deposits



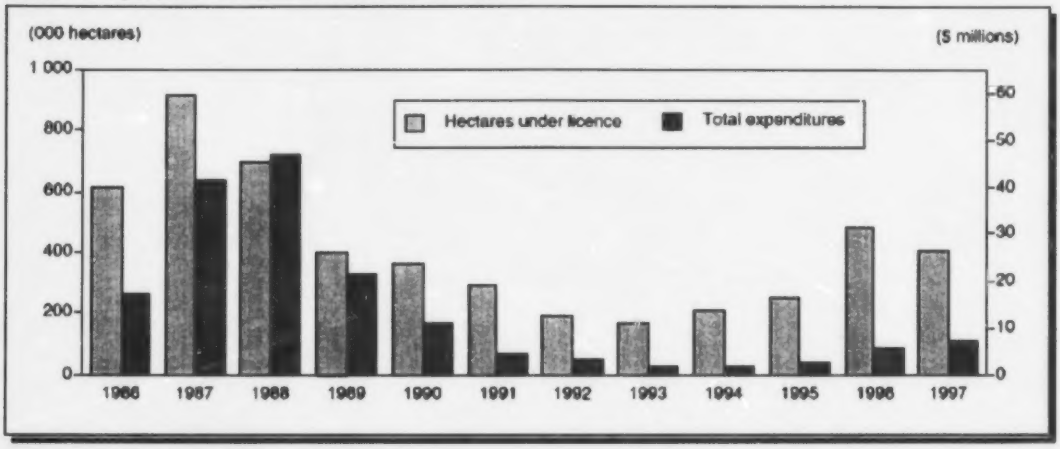
Source: Natural Resources Canada, based on published data

Figure 19
Recoverable Diamond Grades From World Diamond Mines and Canadian Diamond Deposits



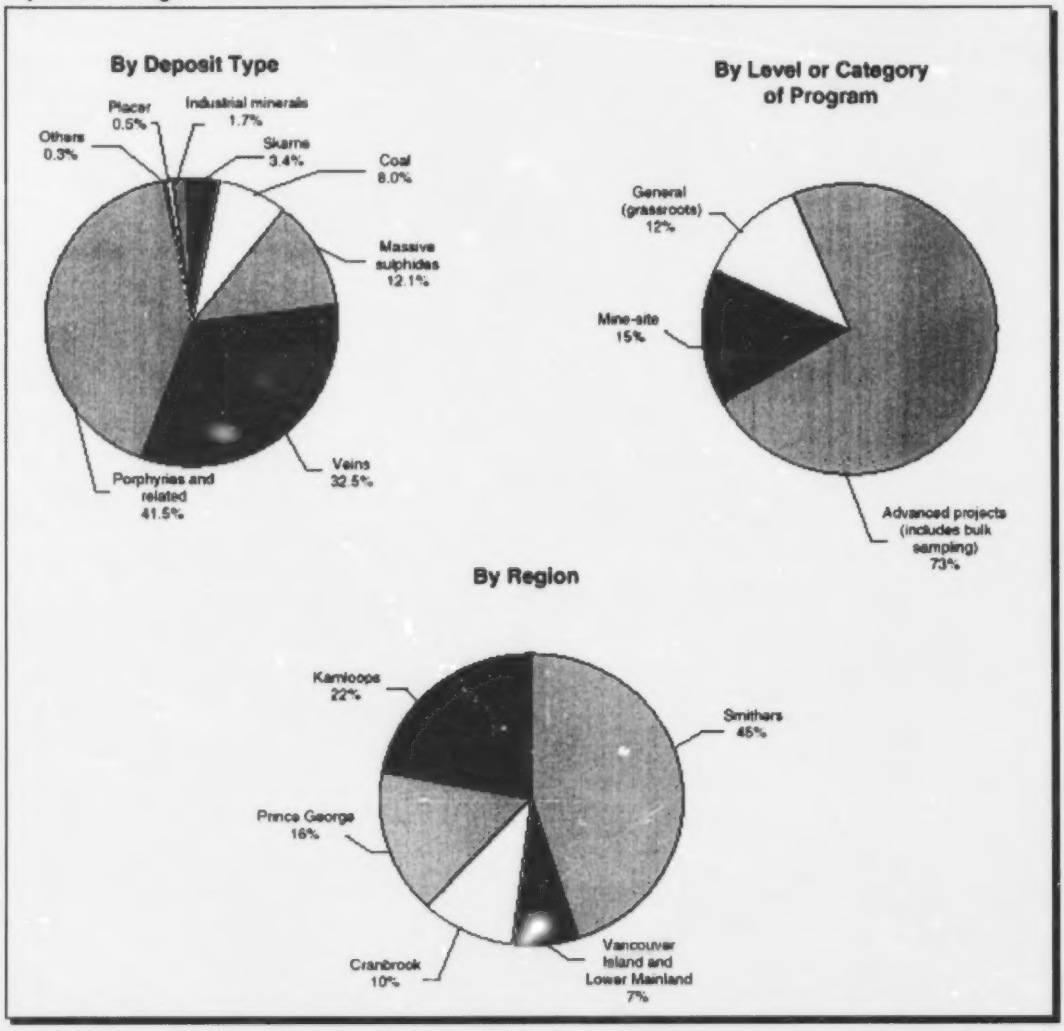
Source: Natural Resources Canada, based on published data.
(1) AK-5034 grade based on a sample of only 104 t of drill core. (2) JD/OD-1 grade based on a sample of only 94.5 t of drill core. (3) Diavik A-418 grade based on a sample of only 63.3 t of drill core. A 3000-t underground bulk sample is currently being processed. (4) Diavik A-154 North grade based on a sample of only 71.7 t of drill core. (5) Diavik A-21 grade based on a sample of only 6.9 t of drill core. (6) Jericho JD/OD-3 grade based on a sample of only 10.53 t of drill core.

Figure 20
Mineral Exploration Trends in Nova Scotia, 1986-97



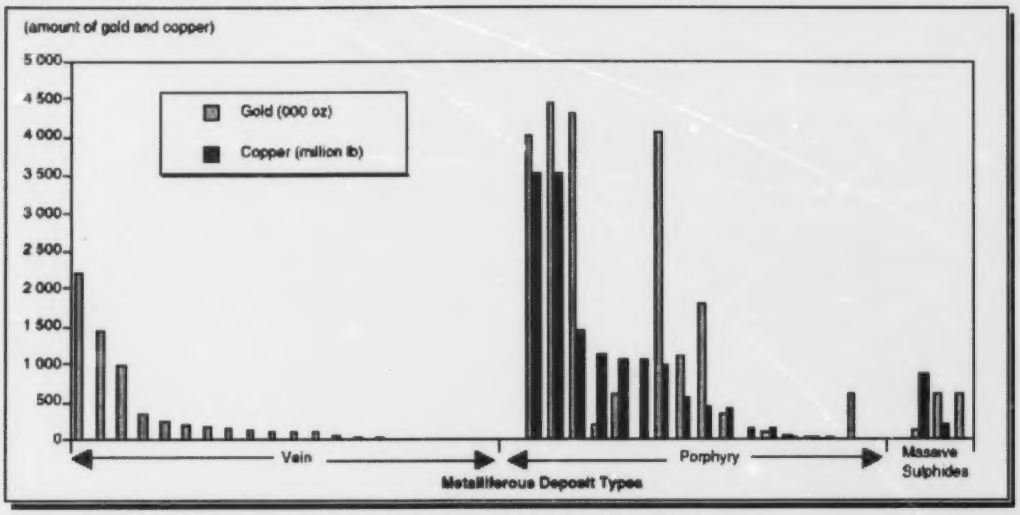
Source: Nova Scotia Department of Natural Resources.
Note: 1996 data are preliminary estimates; 1997 data are forecast.

Figure 21
Exploration Targets in British Columbia, 1996



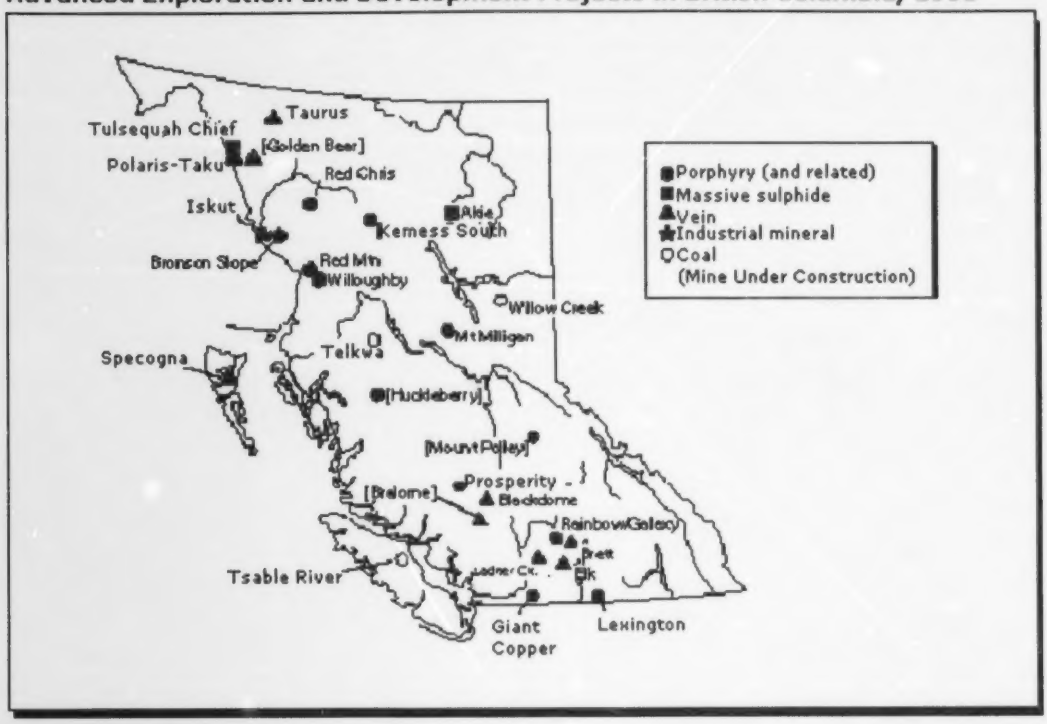
Source: British Columbia Geological Survey Branch, Information Circular 1997-1

Figure 22
"In-Ground" Estimates of the Amount of Gold and Copper in 40 of British Columbia's Current Exploration and Development Projects



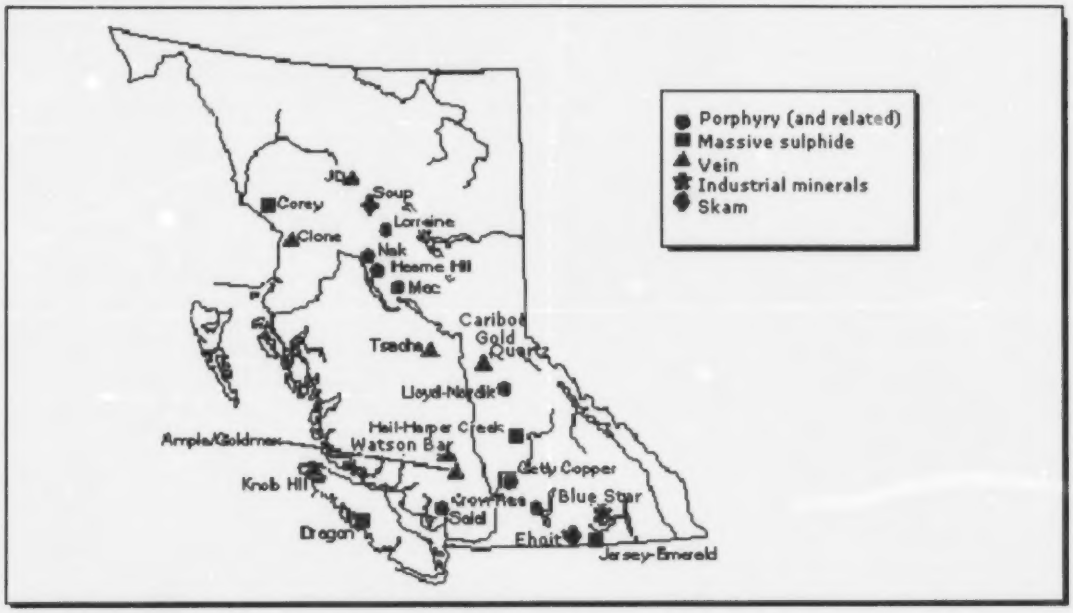
Sources: Ministry of Employment and Investment statistics; British Columbia Geological Survey Branch

Figure 23
Advanced Exploration and Development Projects in British Columbia, 1996



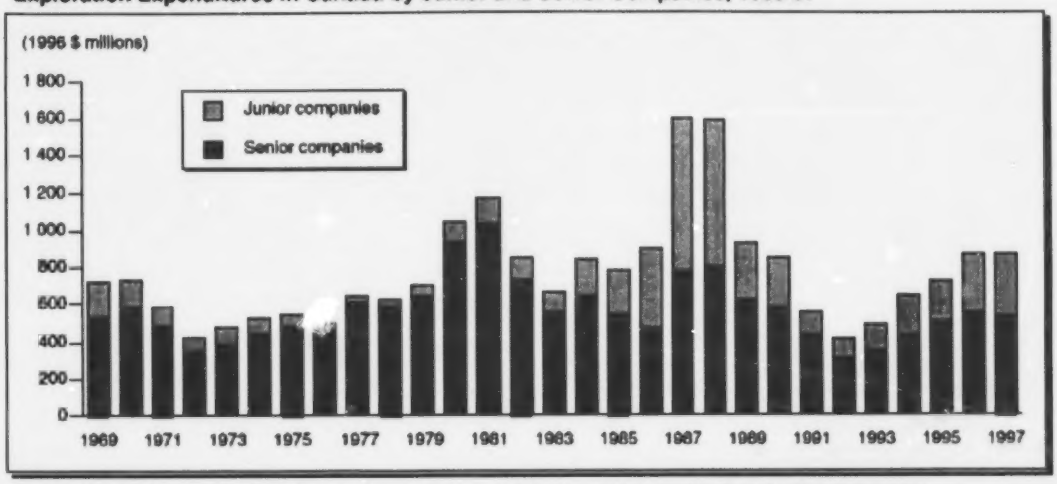
Source: British Columbia Geological Survey Branch, Information Circular 1997-1.

Figure 24
Major Exploration Projects in British Columbia, 1996



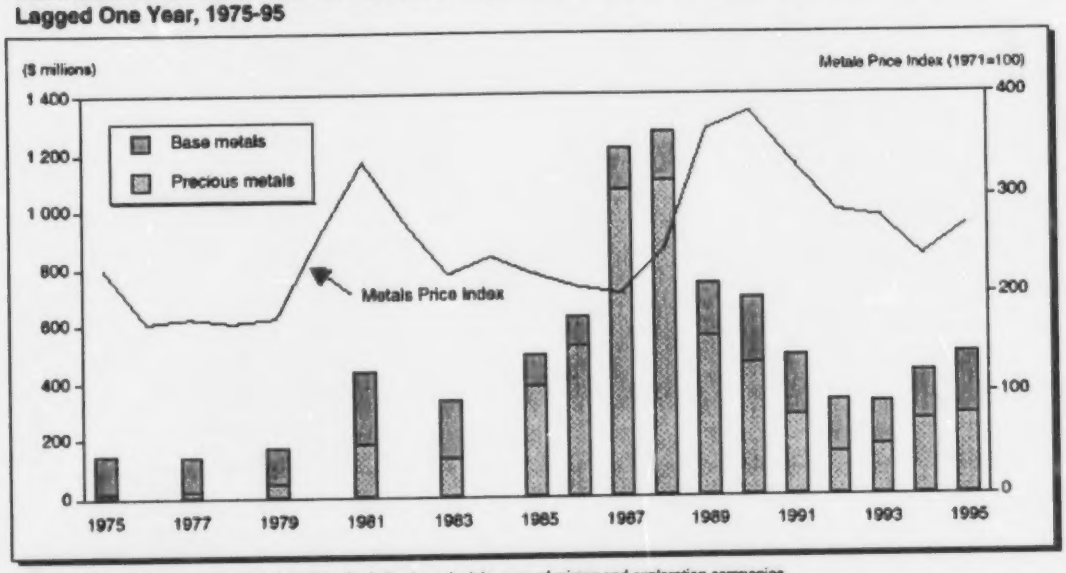
Source: British Columbia Geological Survey Branch, Information Circular 1997-1.

Figure 25
Exploration Expenditures in Canada by Junior and Senior Companies, 1969-97



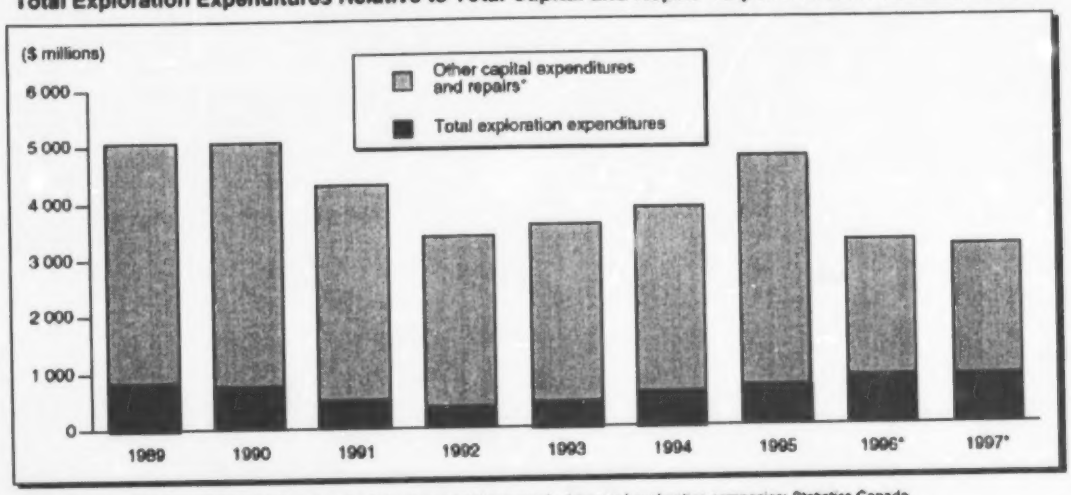
Sources: Natural Resources Canada and Statistics Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: Total exploration expenditures for 1975-81 are overstated by an average of about 17% relative to earlier and later years because of changes to the methodology used by Statistics Canada over the years. Overhead expenditures are included. Data for 1996 are preliminary; data for 1997 are based on a January 1997 survey of company spending intentions.

Figure 26
Base-Metal and Precious-Metal Exploration Expenditures in Canada, and the Metals Price Index Lagged One Year, 1975-95



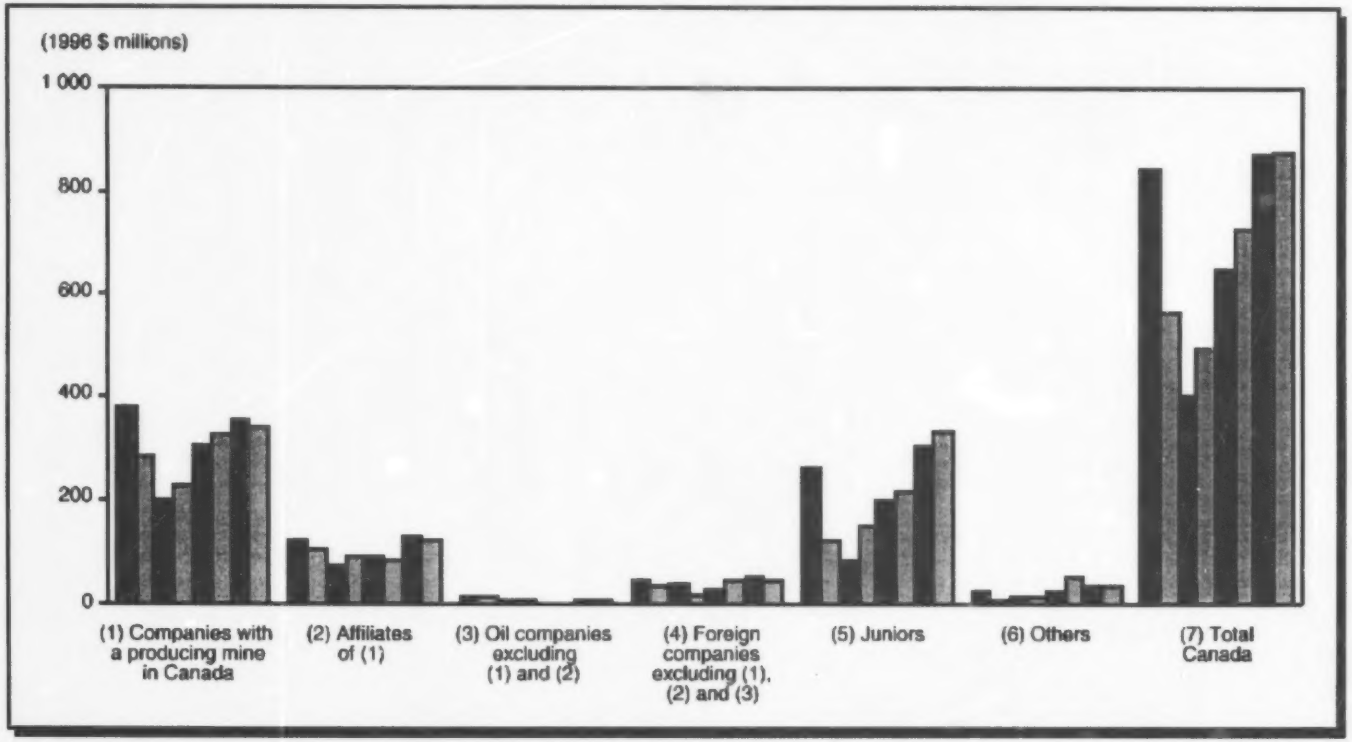
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: Exploration expenditure data by commodity sought are not available for 1976, 1978, 1980, 1982 or 1984. "Lagged" means that the 1974 Metals Price Index is compared to 1975 exploration expenditures, and so on.

Figure 27
Total Exploration Expenditures Relative to Total Capital and Repair* Expenditures in Canada, 1989-97



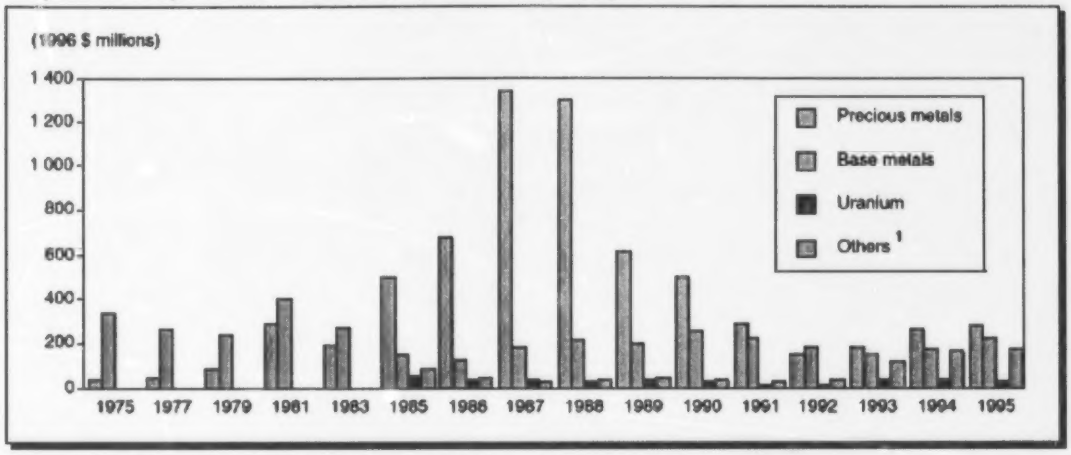
Sources: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies; Statistics Canada.
*Repair expenditures are not available for 1996 and 1997.
Notes: 1996 data are preliminary estimates; 1997 data are company spending intentions as compiled in January 1997. Overhead expenditures are included. "Other capital expenditures" includes expenditures on on-property development, structures, machinery and equipment.

Figure 28
Exploration Expenditures in Canada, by Type of Company, 1990-97



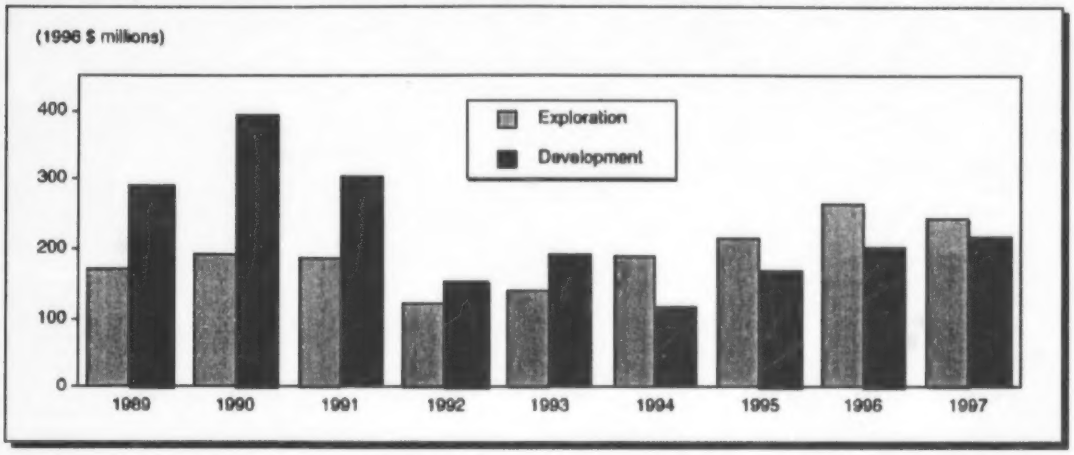
Source: Compiled by Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
Notes: The years 1990 to 1997 are represented in each group. The left bar represents 1990; the right bar represents 1997. 1996 data are preliminary estimates; 1997 data are company spending intentions as compiled in January 1997. Overhead expenditures are included. The company classification system is explained in Appendix A.

Figure 29
Exploration Expenditures in Canada, by Commodity Sought, 1975-95



Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
[1] Includes ferrous metals, other metals, nonmetals (including coal and diamonds), and "not specified."
Notes: Overhead expenditures are included. Data were not compiled by commodity for 1976, 1978, 1980, 1982 and 1984. For 1975, 1977, 1979, 1981 and 1983, only a precious-metal/base-metal breakdown is available.

Figure 30
Mineral Exploration and Development Expenditures in Canada by Foreign-Controlled Firms, 1989-97



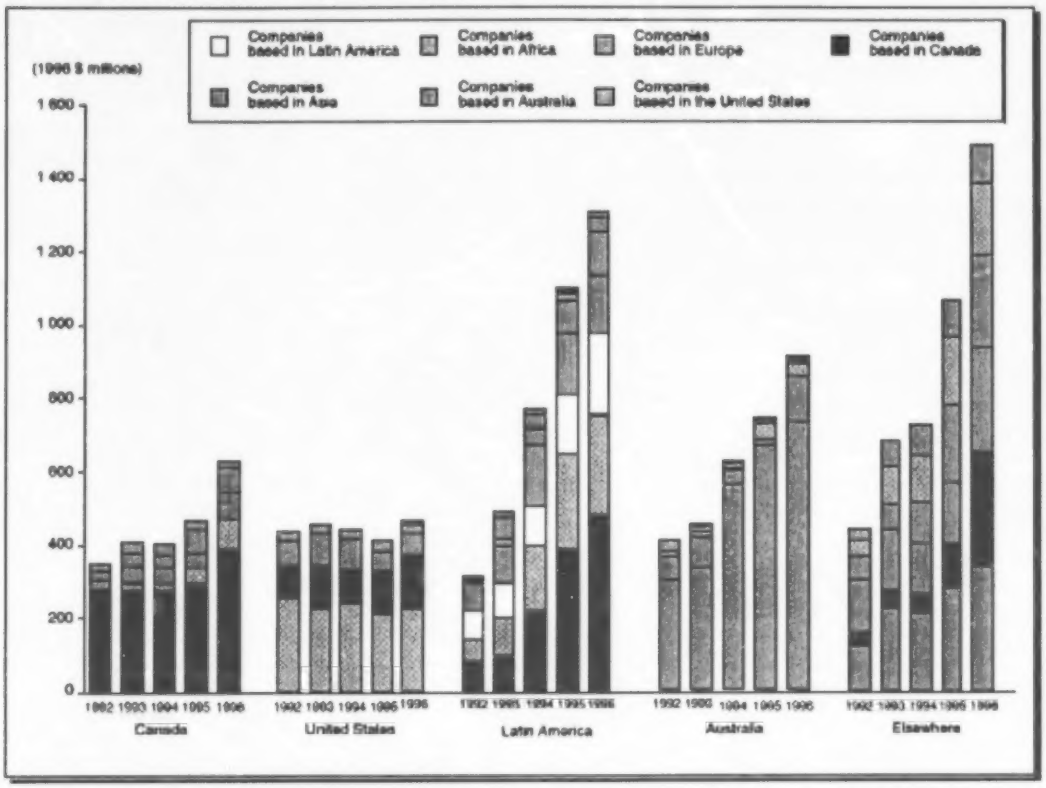
Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies, and on Statistics Canada's CALURA database.
Note: 1996 data are preliminary estimates; 1997 data are company spending intentions as compiled in January 1997.

Figure 31
Top Three Country Destinations of Mineral Exploration Capital from Worldwide Sources, 1971-96

Year	Rank		
	First	Second	Third
1996	Australia	**Canada**	United States
1995	Australia	**Canada**	United States
1994	Australia	**Canada**	United States
1993	Australia	**Canada**	United States
1992	Australia	**Canada**	United States
1991	**Canada**	Australia	United States
1990	**Canada**	Australia	United States
1989	**Canada**	Australia	United States
1988	**Canada**	Australia	United States
1987	**Canada**	Australia	United States
1986	**Canada**	Australia	United States
1985	**Canada**	Australia	United States
1984	**Canada**	Australia	United States
1983	**Canada**	Australia	United States
1982	**Canada**	Australia	United States
1981	**Canada**	Australia	United States
1980	Australia	**Canada**	United States
1979	Australia	United States	**Canada**
1978	Australia	United States	**Canada**
1977	United States	**Canada**	Australia
1976	**Canada**	United States	Australia
1975	United States	**Canada**	Australia
1974	**Canada**	United States	Australia
1973	Australia	United States	**Canada**
1972	United States	Australia	**Canada**
1971	United States	**Canada**	Australia

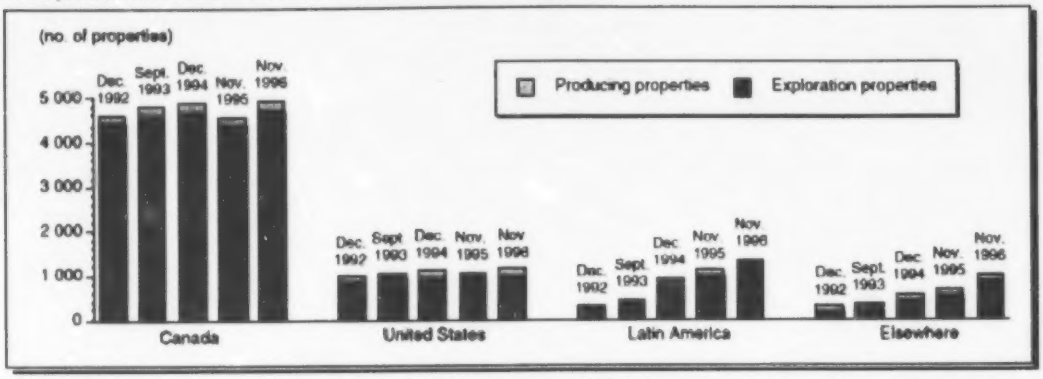
Source: Natural Resources Canada, based on official Canadian and Australian statistics and the best available data for the United States. Australian expenditures were 6.5% higher than those for Canada in 1983 and 3.3% higher in 1991; however, correcting the reported Australian totals for substantial mine development expenditures, which are not included in Canadian statistics, ranks Canada first in 1983 and 1991. No data are available for the former Soviet Union.

Figure 32
Aggregate Exploration Budgets of the World's Larger Companies, by Region, 1992-96
Companies with Worldwide Budgets of at Least $4 million (US$3 million)
for Precious-Metal, Base-Metal or Diamond Exploration



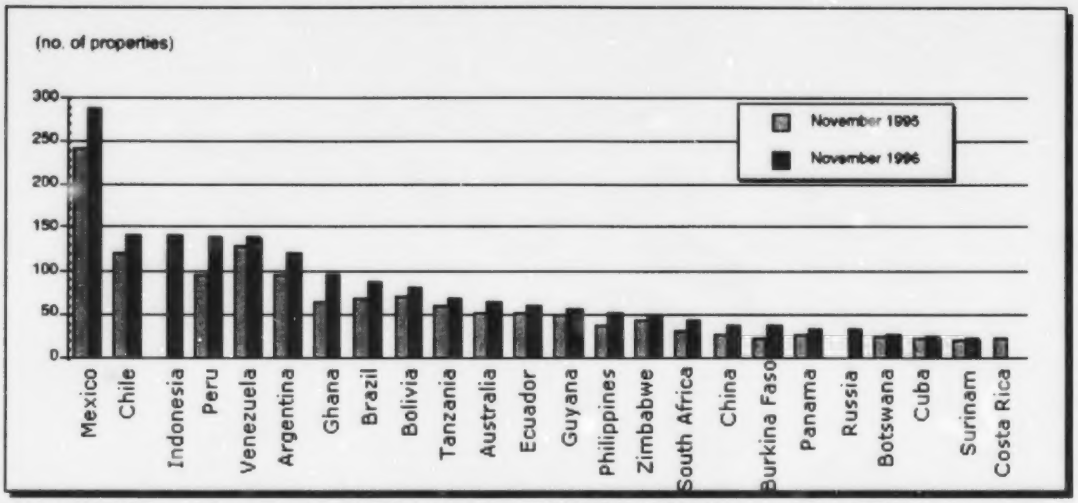
Source: Natural Resources Canada, based on *Corporate Exploration Strategies: A Worldwide Analysis*, Metals Economics Group, Halifax, Nova Scotia.
Notes: Worldwide exploration budgets of companies that intended to spend less than $4 million (US$3 million) annually, of which there are several hundred based in Canada or Australia, are excluded. Worldwide exploration budgets for other commodities such as uranium or industrial minerals are also excluded.

Figure 33
Canadian Mineral Property Portfolio Worldwide, by Region, 1992-96
Companies of All Sizes Listed on Canadian Stock Exchanges



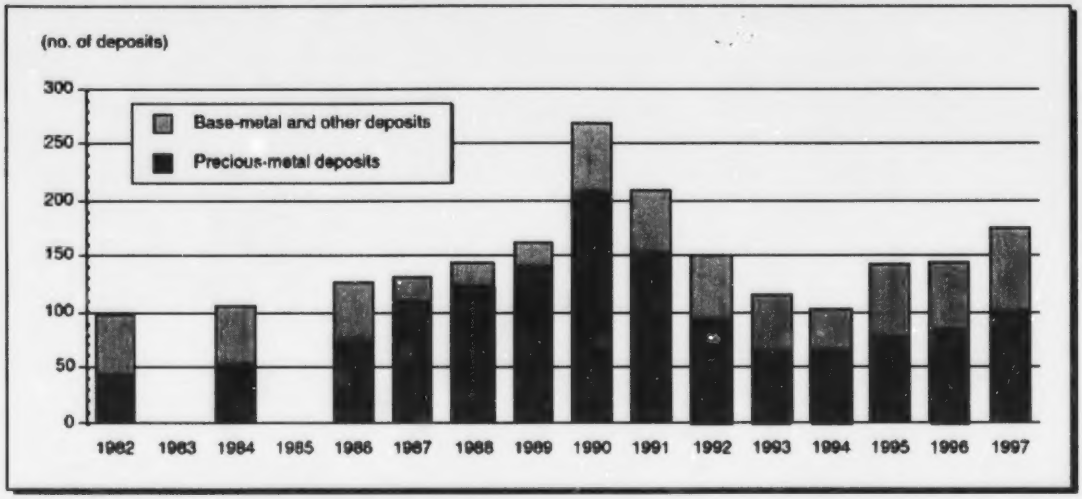
Source: Natural Resources Canada, based on *MIN-MET CANADA* database, ROBERTSON INFO-DATA Inc., Vancouver, British Columbia, and used under licence

Figure 34
Canadian Mineral Property Portfolio Worldwide – Countries Accounting for 80% of Foreign Holdings Located Outside the United States, 1995 and 1996
Companies of all Sizes Listed on Canadian Stock Exchanges



Source: Natural Resources Canada, based on *MIN-MET CANADA* database, ROBERTSON INFO-DATA Inc., Vancouver, British Columbia, and used under licence.

Figure 35
Mineral Deposits Undergoing Active Appraisal in Canada as at January 1 of Each Year, 1982-97



Source: Natural Resources Canada, based on company reports.
Notes: Deposit appraisal includes all of the activities in the process of mineral resource development that must be carried out from the time that a mineral deposit is discovered until sufficient information has been obtained to decide whether or not a production decision is warranted. The deposits currently being appraised contain one or more of barite, bismuth, calcium carbonate, cobalt, copper, chromium, fluorine, gallium, garnet, gold, indium, iron, lead, lithium, magnesium, molybdenum, nickel, palladium, phosphorus, platinum, silver, titanium, tungsten, vanadium, zinc or zircon. Data for 1983 and 1985 were not compiled.

TABLE 1. SURFACE AND UNDERGROUND EXPLORATION DRILLING IN CANADA, 1985-95

Year	Diamond Drilling			Other Drilling [1]		
	Metres Drilled	Total Cost	Cost Per Metre	Metres Drilled	Total Cost	Cost Per Metre
	(000)	($000)	($)	(000)	($000)	($)
1985	2 531	185 994	73	270	10 770	40
1986	3 616	248 579	69	55	3 385	62
1987	6 221	509 950	82	262	18 544	71
1988	6 206	477 509	77	211	10 466	50
1989	3 940	291 399	74	297	9 471	32
1990	3 702	281 982	76	241	12 575	52
1991	2 341	174 789	75	234	13 133	56
1992	1 889	140 765	75	139	6 544	47
1993	1 932	146 780	76	282	12 879	46
1994	2 626	184 068	70	213	12 592	59
1995	2 993	260 543	87	280	11 960	43

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.

[1] Drilling methods such as percussion exploration drilling, reverse circulation drilling for overburden, and rotary drilling (such as used in petroleum exploration) employed in exploration for coal, potash, salt, gypsum and similar layered mineral commodities.

TABLE 2. AREA OF NEW MINERAL CLAIMS[1] STAKED IN CANADA, 1995 AND 1996

Province/Territory	1995		1996	
	(hectares)	(%)	(hectares)	(%)
Newfoundland	6 106 617	38.7	417 575	3.1
Nova Scotia	183 893	1.2	424 815	3.2
New Brunswick	60 464	0.4	93 760	0.7
Québec	1 474 196	9.4	954 967	7.2
Ontario	668 832	4.2	903 488	6.8
Manitoba	210 460	1.3	196 900	1.5
Saskatchewan	340 881	2.2	469 040	3.5
Alberta	1 665 000	10.6	5 328 000	40.2
British Columbia	845 550	5.4	997 740	7.5
Yukon	376 844	2.4	514 483	3.9
Northwest Territories	3 839 299	24.3	2 956 017	22.3
Total	15 772 036	100.0	13 256 785	100.0

Source: Provincial and territorial mining recorders.
[1] Excludes coal.
Note: Percentages do not add to 100 due to rounding.

TABLE 3. AREA OCCUPIED BY CLAIMS IN GOOD STANDING IN CANADA, 1995 AND 1996

Province/Territory	Total Area	Area of Claims in Good Standing	Area of Claims/ Total Area
	(hectares)	(hectares)	(%)
1995			
Newfoundland	40 572 000	6 506 874	16.0
Nova Scotia	5 549 000	241 311	4.3
New Brunswick	7 344 000	294 336	4.0
Québec	154 068 000	2 127 236	1.4
Ontario	106 858 000	2 638 976	2.5
Manitoba	64 995 000	2 868 914	4.4
Saskatchewan	65 233 000	3 693 106	5.7
Alberta	66 119 000	12 700 000	19.2
British Columbia	94 931 000	4 217 694	4.4
Yukon	48 345 000	1 406 588	2.9
Northwest Territories	342 632 000	16 829 078	4.9
Total Canada	996 646 000	53 524 113	5.4
1996			
Newfoundland	40 572 000	4 777 025	11.8
Nova Scotia	5 549 000	457 401	8.2
New Brunswick	7 344 000	344 048	4.7
Québec	154 068 000	2 246 875	1.5
Ontario	106 858 000	2 927 599	2.7
Manitoba	64 995 000	1 752 120	2.7
Saskatchewan	65 233 000	2 378 236	3.6
Alberta	66 119 000	4 370 000	6.6
British Columbia	94 931 000	4 378 664	4.6
Yukon	48 345 000	1 706 406	3.5
Northwest Territories	342 632 000	13 091 150	3.8
Total Canada	996 646 000	38 429 525	4.0

Sources: Natural Resources Canada; provincial mining recorders offices.
Note: Data for Prince Edward Island are not included.

TABLE 4. SELECTED DATA ON CANADA'S MOST PROMISING DIAMOND DEPOSITS

Pipe	Total Tonnes Sampled	Total Carats Recovered	Average Grade (carats/tonne)	Average Value (US$/carat)	Average Value (US$/tonne)
BHP/BLACKWATER GROUP[1]/ LAC DE GRAS PROPERTIES					
Panda	3 402	3 244	0.95	130	124
Misery	1 030	4 313	4.19	26	109
Koala	1 550	1 465	0.95	122	116
Fox	8 223	2 199	0.27	125	34
Leslie[2]	680	223	0.33	89	29
Pigeon[2]	154	60	0.39	51	20
Jay[2]	237.6	476.6	2.01	..	..
Sable	1 096	1 070	0.98	64[a]	63
DIAVIK PROPERTY					
A-154 South	2 900	12 800	4.41	63.00	278
A-154 North	71.72	156.81	2.19	35.10	77
A-418	63.3	247.5	4.02	64.10	258
A-21 (first sample)	6.9	21.49	3.11	..	..
A-21 (second sample)	23.61	..	2.73	..	..
JERICHO PROPERTY					
JD/OD-1[b]	94.5	138	1.46	95	139
JD/OD-3	10.53	7.34	0.697	..	..
AK PROPERTY					
5034	104	257	2.48	..	..

Source: Natural Resources Canada, from company reports.
.. Not available; ct Carats per tonne.
[a] The $64/ct value includes a gem-quality diamond weighing 9 ct. If this stone is excluded, the average value is $48/ct and the average value per tonne is $47. [b] A 15 000-t bulk sample has been mined and is being processed.
[1] The Blackwater Group's 49% interest in this project can be broken down as follows: Dia Met Minerals Ltd., 29%; C. Fipke, 10%; and S. Blusson, 10%. [2] The Leslie, Pigeon and Jay deposits are not currently scheduled for mining.

TABLE 5. A SUMMARY OF MINING RESERVES ON THE BHP MINERALS CANADA LTD./ BLACKWATER GROUP[1] DIAMOND PROPERTY, BY PIPE

	Panda Pit	Misery Pit	Koala Pit	Fox Pit	Sable Pit	Panda U/G	Koala U/G	Total
				(million tonnes of ore)				
Proven	8.6	4.8	10.0	8.1	11.0	–	1.0	43.5
Probable	4.0	0.7	4.6	8.6	1.9	0.8	1.8	22.4
Total	12.6	5.5	14.6	16.7	12.9	0.8	2.8	65.9
Grade (ct/t on a diluted basis)	1.09	4.26	0.76	0.40	0.93	0.97	1.63	1.09
Average Value (US$/ct)	130	28	122	125	64	130	122	84

Source: Natural Resources Canada.
– Nil; ct/t Carats per tonne; U/G Underground.
[1] The Blackwater Group is comprised of Dia Met Minerals Ltd., C. Fipke, and S. Blusson.

TABLE 6. NEWFOUNDLAND AND LABRADOR EXPLORATION STATISTICS, 1989-97

	1989	1990	1991	1992	1993	1994	1995
					(dollars)		
Annual exploration expenditures	38 200 009	23 274 537	12 064 993	11 140 752	8 905 864	12 396 462	71 113
Exploration expenditures							
Base metals[1]	8 141 579	8 065 645	7 022 790	5 948 578	3 719 325	5 216 623	64 226
Precious metals	16 420 301	9 195 651	1 876 256	1 285 629	1 867 878	3 613 526	5 371 50
Other	1 364 328	1 520 051	550 502	1 192 898	1 192 898	884 000	1 241 00
					(number)		
Claim staking							
Claims staked	17 571	10 421	7 411	5 118	6 855	22 256	248 70
In good standing	65 223	45 427	33 297	24 002	22 910	36 698	280 75
					(metres)		
Diamond drilling [2]							
Production/development	16 355	8 884	6 850	819	16 982	7 260	3 10
Exploration	104 493	82 833	39 067	21 923	31 020	39 366	120 80
Total diamond drilling	120 848	91 717	45 917	22 742	48 002	46 626	128 91

Source: Newfoundland Department of Mines and Energy.
.. Not available: f Forecast; p Preliminary.
[1] Includes cobalt. [2] Based on a special provincial diamond drilling survey.

TABLE 7. NOVA SCOTIA MINERAL EXPLORATION STATISTICS, 1992-97

	1992	1993	1994	1995	1996	1997f
Exploration expenditures (field + overhead, general + mine-site) ($)	3 258 000	1 797 000	1 714 000	2 843 000	5 752 000p	6 656 000
Claim staking (new and reissued) (general + special licences) (no. of claims)	12 229	10 759	14 614	16 407	30 400e	25 000
Exploration diamond drilling (metres)	12 710	6 221	7 725	8 000	9 000e	12 000

Source: Nova Scotia Department of Natural Resources.
e Estimated; f Forecast; p Preliminary.

TABLE 8. NEW BRUNSWICK MINERAL EXPLORATION STATISTICS, 1993-97

	1993	1994	1995	1996	1997f
Exploration expenditures (general and mine-site) ($ millions)1	11.1	10.9	12.7	16.1a	15.9
Mineral claims recorded (no.)	2 351	3 980	3 779	5 860	..
Total claim equivalents in effect (no.)	22 453	23 872	18 396	21 503	..

Source: New Brunswick Department of Natural Resources and Energy.
.. Not available; f Forecast.
a Preliminary survey results.
1 Current dollars; includes overhead expenses.

TABLE 9. QUÉBEC, FLOW-THROUGH SHARE FINANCING AND EXPLORATION EXPENDITURES, 1993-97

	1993	1994	1995	1996p	1997•
			($ millions)		
Value of flow-through share issues	27.4	18.4	26.4	27.8	..
Exploration expenditures	111.8	136.6	131.6	135.3	122.8
Off-property	91.9	113.5	105.8	114.3	106.6
On-property	19.9	23.1	25.8	21.0	16.2

Source: Service de la recherche en économie minérale, Ministère des Ressources naturelles du Québec.
.. Not available; • Estimates derived from the survey conducted in the fall of 1996; p Preliminary data.

TABLE 10. QUÉBEC, $1000 FLOW-THROUGH SHARE INVESTMENT FOR SURFACE EXPLORATION

Taxable Income	Marginal Tax Rate			Tax Savings			Net Investment Cost	After-Tax Break-Even
	Federal	Québec	Total	Federal (1)	Québec (2)	Total (1+2)	$1000 - (1+2)	
		(%)			($)		($)	($)
$40 000	22.49	24.61	47.10	225	431	656	344	
$50 000	22.49	25.68	48.17	225	449	674	326	
$60 000	25.09	26.40	51.49	251	462	713	287	
$70 000	26.54	26.40	52.94	265	462	727	273	

Source: Ministère des Ressources naturelles du Québec.

1 New issues often comprise flow-through shares and common shares sold as units. In such cases, the tax deduction will be proportion number of flow-through shares included in each unit. 2 The break-even point takes into account current income tax provisions relating gains and the reduction available in Québec by means of the special account that shelters the deemed capital gain from taxation that ex the cost of flow-through shares.

Notes: Flow-through shares for surface exploration generate a deduction of 175% at the provincial level and 100% at the federal level. The table reflects income tax provisions applicable for the 1996 calendar year for a Québec taxpayer who is an individual and who is no to the minimum alternative tax. Marginal tax rates take into account provincial and federal surtaxes, the Québec tax reduction (2% of th over $10 000 of tax payable net of non-refundable tax credits) as well as a federal basic non-refundable credit of $1098 and a provincia non-refundable tax credit of $1180. Issue expenses are not taken into account.

TABLE 11. SASKATCHEWAN EXPLORATION EXPENDITURES, 1988-97

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997•
	($ millions)									
Precious metals	42	20	11	5	6	2	4	8	7	6
Base metals	6	7	7	6	4	4	4	4	5	10
Uranium	20	21	12	10	8	7	11	13	17	24
Other	–	2	2	3	4	11	10	4	6	4
Total	68	50	32	24	22	24	29	29	35	44

Source: Resident Geologists' Survey, Saskatchewan Department of Energy and Mines.
– Nil; • Estimated.
Note: "Other" includes some industrial mineral activity, but predominantly diamond exploration.

TABLE 12. KIMBERLITE PIPES TO BE MINED UNDER BHP MINERALS CANADA LTD./DIA MET MINERALS LTD. DIAMONDS PROJECT MINING PLAN

Kimberlite Pipe	Average Grade	Reserves	Average Value
	(carats per tonne)	(million tonnes)	(US$/carat)
Panda	1.09 0.97 U/G	12.6 0.8 U/G	130
Misery	4.26	5.5	26
Koala	0.76 1.63 U/G	14.6 2.8 U/G	122
Sable	0.93	12.9	64
Fox	0.40	16.7	125

Source: N.W.T. Department of Resources, Wildlife and Economic Development.
U/G Underground.
Note: Values are for open-pit methods unless otherwise stated.

TABLE 13. MINERAL EXPLORATION EXPENDITURES IN CANADA, BY PROVINCE AND TERRITORY, 1986-97 (CURRENT DOLLARS)

Province/Territory	Field Work Only			Total Exploration[1]								
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996P	1997F
	($ millions)											
Newfoundland	12.3	27.7	37.7	36.2	23.3	12.1	11.1	8.9	12.4	71.1	91.2	73.3
Nova Scotia	17.2	41.6	46.7	21.4	11.0	4.5	3.3	1.8	1.7	2.8	5.8	6.7
New Brunswick	10.8	9.1	13.8	13.6	15.5	15.8	12.2	11.1	10.0	12.7	16.1	15.9
Québec	241.4	415.5	328.2	165.0	196.4	138.1	94.1	106.1	130.3	123.4	126.3	115.8
Ontario	136.3	308.1	348.6	217.8	152.6	109.7	77.4	75.6	113.0	129.7	177.9	189.6
Manitoba	20.3	40.0	30.0	37.0	41.2	29.7	32.0	27.4	40.5	32.6	40.1	41.7
Saskatchewan	36.5	63.5	61.1	63.2	42.2	31.5	25.9	53.1	50.6	42.6	45.0	55.7
Alberta	3.0	2.5	4.3	6.2	10.7	6.6	5.4	7.9	9.4	10.6	13.6	11.3
British Columbia	63.1	142.6	196.8	186.6	226.5	135.7	71.6	66.0	85.0	79.4	116.5	126.3
Yukon Territory	27.9	25.0	36.6	15.1	15.4	16.5	9.7	15.2	25.7	25.3	54.9	57.5
Northwest Territories	35.8	59.0	66.5	45.7	36.0	31.6	42.7	100.7	149.5	172.2	183.2	178.8
Total field work (excluding overhead)	611.4	1 136.6	1 167.3	703.5	660.3	436.2	323.5	410.1	540.5	608.1	..	..
Total exploration[2] (including overhead)	723.3	1 300.0	1 350.0	827.9	774.7	531.8	385.3	477.3	628.1	717.6	872.6	876.0

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
.. Not available; F Forecast; P Preliminary estimate.
1 "Total exploration" includes related overhead expenditures. 2 For the years 1986-88, totals with overhead were calculated by multiplying the field expenditures by the ratio total/field from Statistics Canada.
Note: Numbers may not add to totals due to rounding.

TABLE 14. MINERAL EXPLORATION EXPENDITURES IN CANADA, BY PROVINCE AND TERRITORY, 1986-97 (1996 DOLLARS)

Province/Territory	Field Work Only			Total Exploration[1]								
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996p	1997f
	($ millions)											
Newfoundland	15.9	34.2	44.4	40.7	25.4	12.8	11.7	9.2	12.7	72.0	91.2	78.3
Nova Scotia	22.2	51.3	55.0	24.0	12.0	4.8	3.4	1.9	1.6	2.9	5.8	6.7
New Brunswick	13.9	11.2	16.3	15.3	18.0	16.7	12.8	11.5	10.2	12.9	16.·	15.5
Québec	311.5	512.3	386.6	207.9	213.9	146.3	98.4	109.8	133.9	124.9	128.3	115.8
Ontario	176.5	379.9	404.7	244.7	166.2	116.2	81.0	79.2	116.1	131.3	177.9	189.0
Manitoba	30.9	49.3	35.3	41.6	44.8	31.5	33.4	28.4	41.6	33.0	40.·	41.7
Saskatchewan	47.5	78.3	72.0	71.·	46.0	33.4	27.·	55.0	52.0	44.3	45.0	56.7
Alberta	3.9	3.1	5.1	7.0	11.7	7.0	5.6	7.6	9.7	10.7	13.6	11.2
British Columbia	81.4	175.3	231.8	209.7	246.7	143.9	74.9	58.0	87.0	80.4	116.5	126.0
Yukon Territory	36.0	35.9	45.5	17.0	20.0	17.5	10.·	19.9	20.4	39.8	54.9	57.9
Northwest Territories	46.2	72.7	78.3	51.3	39.2	33.5	44.7	104.3	153.7	174.2	183.2	178.8
Total field work (excluding overhead)	788.9	1 403.9	1 374.5	790.4	719.3	465.3	338.3	424.8	555.5	615.5	..	..
Total exploration[2] (including overhead)	933.3	1 603.0	1 590.1	930.2	843.9	563.3	403.1	494.1	645.6	726.3	872.6	876.0

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
.. Not available; f Forecast; p Preliminary estimate
1 "Total Exploration" includes related overhead expenditures. 2 For the years 1986-88, totals with overhead were calculated by multiplying the field expenditures by the ratio total/field from Statistics Canada.
Note: Numbers may not add to totals due to rounding

TABLE 15. MINERAL EXPLORATION EXPENDITURES IN CANADA, BY PROVINCE AND TERRITORY, 1986-97 (PERCENT DISTRIBUTION)

Province/Territory	Field Work Only			Total Exploration					
	1986	1987	1988	1989	1990	1991	1992	1993	1994
						(%)			
Newfoundland	2.0	2.4	3.2	4.4	3.0	2.3	2.9	1.9	2.0
Nova Scotia	2.8	3.7	4.0	2.6	1.4	0.8	0.8	0.4	0.3
New Brunswick	1.8	0.8	1.2	1.6	2.1	3.0	3.2	2.3	1.6
Québec	39.5	36.5	26.1	22.3	25.4	26.0	24.4	22.2	20.7
Ontario	22.4	27.1	29.4	26.3	19.7	20.6	20.1	15.8	18.0
Manitoba	4.3	3.5	2.6	4.5	5.3	5.6	8.3	5.7	6.5
Saskatchewan	6.0	5.6	5.2	7.6	5.4	5.9	6.7	11.1	8.1
Alberta	0.5	0.2	0.4	0.7	1.4	1.2	1.4	1.5	1.5
British Columbia	10.3	12.5	16.9	22.5	29.2	25.5	18.6	13.8	13.5
Yukon Territory	4.6	2.5	3.3	1.8	2.4	3.1	2.5	4.0	4.1
Northwest Territories	5.9	5.2	5.7	5.5	4.6	5.9	11.1	21.1	23.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
f Forecast; p Preliminary estimate.
Notes: The percentages from 1986-88 are calculated on field work only, but those from 1989-97 are based on total expenditures, which inc
Numbers may not add to totals due to rounding.

TABLE 16. RATE OF GROWTH OF EXPLORATION EXPENDITURES: CANADA COMPARED TO THE REMAINDER OF THE WORLD, 1991-97

Year	Exploration Expenditures in Canada [1]		Exploration Budgets in the Remainder of the World [2]	
	Growth Compared to Low Year 1992		Growth Compared to Low Year 1992	
	(C$ millions)	(%)	(US$ millions)	(%)
1991	531.8	n.a.	1 846	n.a.
1992	385.3	n.a.	1 610	n.a.
1993	477.3	+24	1 900	+18
1994	628.1	+63	2 130	+32
1995	717.6	+86	2 690	+67
1996	872.6P	+126	3 520	+119
1997	876.0I	+127	..	..

Source: Natural Resources Canada.
.. Not available; I Company spending intentions (January 1997); n.a. Not applicable; P Preliminary.
1 Federal-provincial survey of mining and exploration companies. 2 Metals Economics Group survey.

TABLE 17. CANADA, COMPARISON OF INTENTIONS, PRELIMINARY AND ACTUAL EXPLORATION EXPENDITURES, 1985-97

Exploration Expenditures	Intentions	Preliminary	Actual	Actual/Intentions
		($ millions)		(%)
1985				
Mine-site	150.9	89.4	100.1	
General	361.2	471.5	488.8	
Total	512.1	560.9	588.9	+15
1986				
Mine-site	87.5	110.2	108.6	
General	431.2	483.6	589.3	
Total	518.7	593.8	897.9	+35
1987				
Mine-site	122.6	121.5	161.0	
General	583.2	849.6	1 139.0	
Total	705.8	971.1	1 300.0	+84
1988				
Mine-site	154.7	138.7	143.0	
General	891.0	1 107.9	1 207.0	
Total	1 045.7	1 246.6	1 350.0	+29
1989				
Mine-site	111.7	160.0	115.3	
General	832.2	766.7	712.5	
Total	943.9	926.7	827.8	-12
1990				
Mine-site	150.0	107.7	112.4	
General	633.0	643.5	662.3	
Total	783.0	751.2	774.7	-1
1991				
Mine-site	97.9	80.4	67.3	
General	548.3	514.4	464.4	
Total	646.2	594.8	531.7	-18
1992				
Mine-site	71.2	75.4	59.4	
General	426.3	344.2	325.9	
Total	497.5	419.6	385.3	-23
1993				
Mine-site	70.1	78.1	64.0	
General	364.5	404.9	413.2	
Total	434.6	483.0	477.2	+10
1994				
Mine-site	66.0	68.3	72.3	
General	470.9	561.8	555.8	
Total	536.9	630.1	628.1	+17
1995				

Mine-site	67.9	76.9	86.4	
General	586.8	686.6	631.2	
Total	654.7	763.5	717.6	+10
1996				
Mine-site	79.4	98.3		
General	865.8	774.2		
Total	945.2	872.5	..	..
1997				
Mine-site	104.8			
General	771.2			
Total	876.0	..	..	..

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
.. Not available.

TABLE 18. TWO MAIN EXPLORATION PROPERTIES OR GROUPS OF PROPERTIES, BY CANADIAN PROVINCE AND TERRITORY, 1996

Province/Territory	Company	Main Project	Commodity
Newfoundland and Labrador	Voisey's Bay Nickel Company Ltd.	Voisey's Bay	Nickel, copper, cobalt
	Castle Rock Exploration Corporation	Harp Lake and Wilson Lake (Labrador), Putt property, Okak Bay (north of Voisey's Bay)	Nickel, copper, cobalt
Nova Scotia	Tusket Mining Inc.	Murcheyville property (Halifax County)	Gypsum
	Kaoclay Resources Inc.	Musquodoboit Valley area (Halifax County)	Clay
New Brunswick	Noranda Mining and Exploration	Bathurst Camp area (various properties),	Zinc, lead, copper
		Brunswick mine[1]	Zinc, lead, copper
Québec	SOQUEM	Chibougamau, Abitibi and Granville townships	Copper, zinc, silver, gold, nickel
	Agnico-Eagle Mines Ltd.	Vezza and Goldex Extension	Gold
Ontario	Outokumpu Mines Ltd.	Montcalm property	Nickel, copper
	Sudbury Contact Mines Ltd.	Victoria Creek property	Gold
Manitoba	Hudson Bay Exploration & Development Ltd.	Exploration includes: Flin Flon, Snow Lake, Leaf Rapids, Lynn Lake, south extension of Thompson Nickel Belt	Copper, zinc, nickel
	Inco Limited	Pipe Deep, and properties in northern Superior area and Thompson Nickel Belt	Nickel
Saskatchewan	Cogema Resources Inc.	Athabasca Basin east and west (approximately 15 properties)	Uranium
	Cameco Corporation	McArthur River	Uranium
Alberta	Cardinal River Coals Ltd.	Cheviot mine	Coal
	Birch Mountain Resources Ltd.	Bradley properties at Fort MacKay	Gold
British Columbia	Royal Oak Mines Inc.	Red Mountain property	Gold
	Misty Mountain Gold Ltd.	Harmony Gold property	Gold
Yukon	United Keno Hill Mines Ltd.	Keno Hill: formerly Bellekeno and Silver King mines	Silver, lead, zinc
	Cominco Ltd.	Kudz Ze Kayah	Copper, lead, zinc, silver, gold
Northwest Territories	Diavik Diamond Mines Inc.	Diavik	Diamonds
	Lytton Minerals Limited	Jericho	Diamonds
	Forecast Exploration ($ millions)		**% of Total Canadian Expenditures**
Total for these projects	237.2		27.2
Total for these companies	253.4		29.0

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
[1] Mine-site exploration project.

TABLE 19. TWO MAIN EXPLORATION PROPERTIES OR GROUPS OF PROPERTIES, BY CANADIAN PROVINCE AND TERRITORY, 1997

Province/Territory	Company	Main Project	Commodity
Newfoundland and Labrador	Voisey's Bay Nickel Company Ltd.	Voisey's Bay	Nickel, copper, cobalt
	NDT Ventures Ltd.	Voisey's Bay area and north	Nickel, copper, cobalt
Nova Scotia	Kaoclay Resources Inc.	Musquodoboit Valley area (Halifax County)	Clay
	RJZ Mining Inc.	Halifax and Guysborough counties	Gold
New Brunswick	Noranda Mining and Exploration	Bathurst Camp area (various properties),	Zinc, lead, copper
		Brunswick mine [1]	Zinc, lead, copper
Québec	SOQUEM	Chibougamau, Abitibi and Grenville townships	Copper, zinc, silver, gold, nickel
	Société minière Raglan du Québec	Raglan	Nickel
Ontario	Falconbridge Limited	(Sudbury) Craig and Onaping mines [1]	Copper, zinc, nickel
	Placer Dome Canada Ltd.	Detour Lake mine - QK zone [1]	Gold
Manitoba	Hudson Bay Exploration & Development Ltd.	Exploration includes: Flin Flon, Snow Lake, Leaf Rapids, Lynn Lake, south extension of Thompson Nickel Belt	Copper, zinc, nickel
	Inco Limited	Pipe Deep, and properties in northern Superior area and Thompson Nickel Belt	Nickel
Saskatchewan	Cameco Corporation	McArthur River	Uranium
	Cogema Resources Inc.	Athabasca Basin (approximately 15 properties)	Uranium
Alberta	Cardinal River Coals Ltd.	Cheviot mine	Coal
	Manalta Coal Ltd.	Drinnan Creek	Coal
British Columbia	Taseko Mines Limited	Prosperity (former Fish Lake property)	Gold
	Booker Gold Explorations	Hearne Hill Property	Gold, copper
Yukon	United Keno Hill Mines Ltd.	Keno Hill: formerly Bellekeno and Silver King mines	Silver, lead, zinc
	Columbia Gold Mines Ltd.	Fyre Lake property	Copper, cobalt, gold
Northwest Territories	Diavik Diamond Mines Inc.	Diavik	Diamonds
	Lytton Minerals Limited	Jericho	Diamonds

	Forecast Exploration ($ millions)	% of Total Canadian Expenditures
Total for these projects	245.6	28.0
Total for these companies	278.7	32.1

Source: Natural Resources Canada, based on the federal-provincial survey of mining and exploration companies.
[1] Mine-site exploration projects.